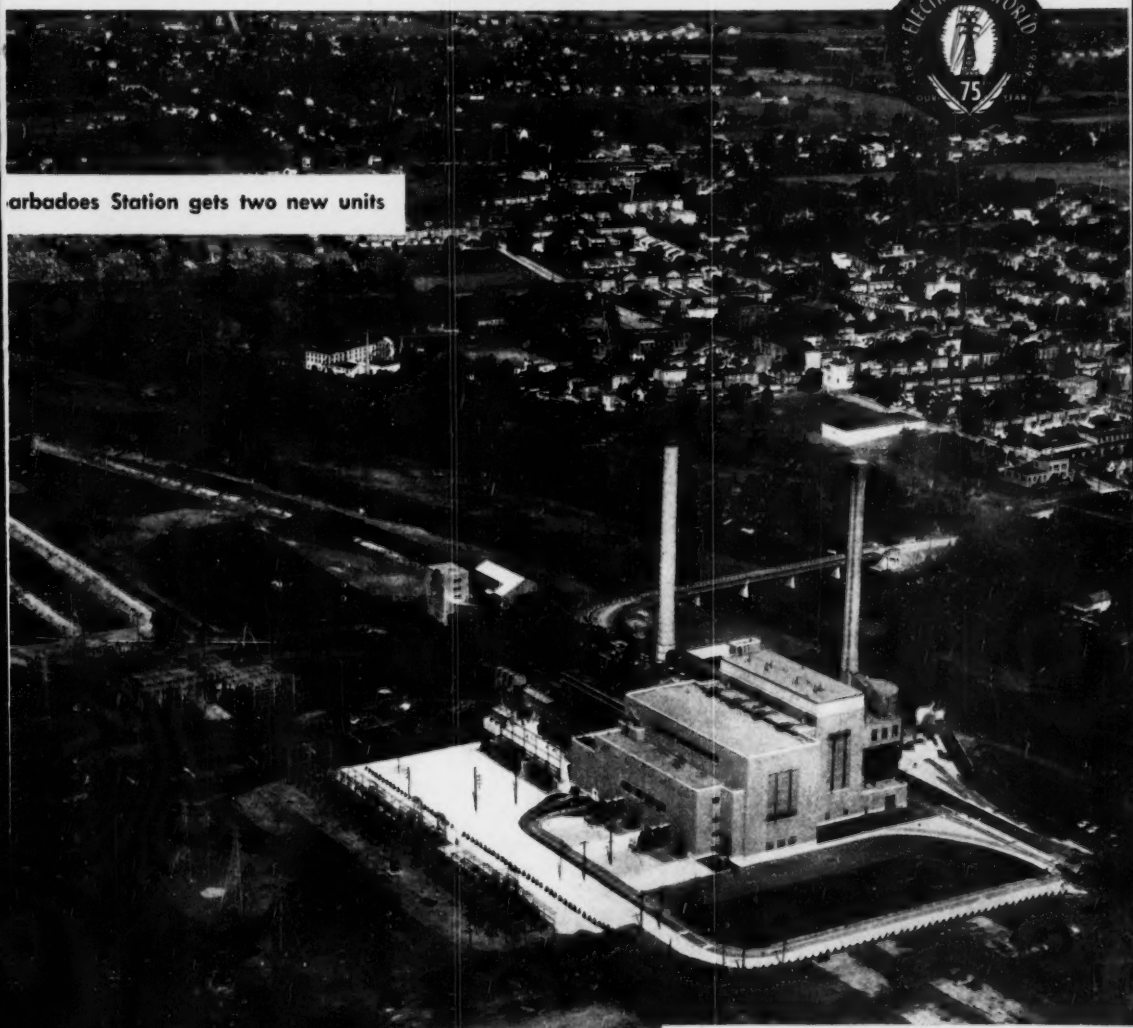
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

NOVEMBER 5, 1949



arbadoes Station gets two new units

In This Issue

How Latest Mercury Units Are Performing

•

Unit Substation vs. Structural Steel Type

•

Electronic Control for Street Lighting

(Model 901) PORTABLE TEST INSTRUMENTS available in DC, Model 901—and AC, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

SENSITIVE RELAYS a line of sensitive relays including the Model 705 which provides positive control at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

(Model 622) ULTRA-SENSITIVE INSTRUMENTS portable DC and AC Thermo instruments for precision measurement of potentials and minute currents involving electronics, thermo-couples or laboratory research.

INSTRUMENTS

TO SPEED AND SIMPLIFY ELECTRONIC PRODUCTION AND MAINTENANCE

Illustrated are but a few of the many specialized instruments available from WESTON . . . all designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. For details, see your local representative, or write Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHARLOTTE • CHICAGO
CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HOUSTON
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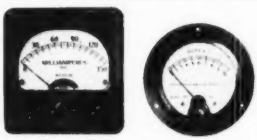
SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE • TULSA
IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

(Model 798) MULTI-PURPOSE TUBE-CHECKER offering provision for testing Receiving Tubes — Voltage Regulator Tubes—Light Duty Thyratron Tubes such as 2A4—6D4—884—885—2051. Scale is calibrated "Good-Bad" as well as in mutual conductance range.

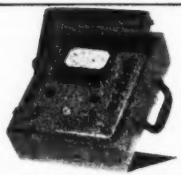


PANEL and SWITCHBOARD INSTRUMENTS a complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including DC, AC power frequencies and radio frequency, rectifier types and D.B. meters.

(Model 697) VOLT-OHM MILLIAMMETER one of a line of pocket-size meters, Model 697 combines a selection of AC and DC voltage, DC current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

(Model 785) INDUSTRIAL CIRCUIT TESTER a versatile, portable tester for laboratory or maintenance needs, where an ultra-sensitive instrument is required. Provides 27 AC and DC voltage, AC and DC current, and resistance ranges. (DC sensitivity 20,000 ohms per volt.)

(Model 779, Type 1) SUPER-SENSITIVE ANALYZER small, light, compact, 26 range Volt-Ohm-Milliammeter with 5 DC voltage ranges, sensitivity of 1000 or 20,000 ohms per volt. AC temperature compensated. Self-contained power supply. Ideal for many production and test requirements.



(Model 769) ELECTRONIC ANALYZER incorporating a conventional Volt-Ohm-Milliammeter with self-contained power source—a high-impedance electronic Volt-Ohmmeter using 115 volt, 60 cycle power—a stable, probe-type, Vacuum Tube Voltmeter, for use to 300 megacycles.

ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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COVER—Seen from the air is Philadelphia Electric Co's newly-expanded Barbadoes Station on its island in the Schuylkill River opposite Norristown. This view made by Aero Service Corp was supplied by courtesy of Dravo Corp, construction agents

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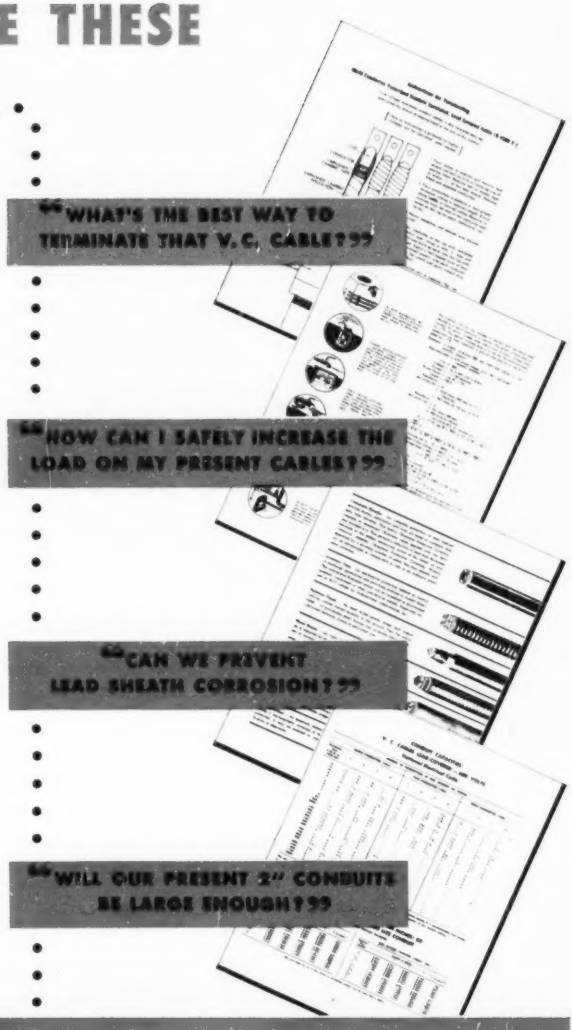
QUESTIONS LIKE THESE *fully answered . . .*

All these questions and many more about varnished cambric insulated cables are fully answered in Okonite's new 44-page manual on OKOVAR Wires and Cables. Based on nearly 40 years of manufacturing and field experience, the material in this bulletin includes application charts, cable designs and dimensions, and descriptions of the right protective covering for each specific condition. Engineering tables cover current-carrying capacities, considerations for increased current loadings, voltage constants, conduit capacities, proper bending radii, splicing instructions, and other important data for ready reference.

In these days of high installation costs it is vitally important to select the cable design that will give greatest over-all economy, with simple installation and operational efficiency. This OKOVAR manual shows in detail how to do exactly this.


"WHAT'S THE BEST WAY TO TERMINATE THAT V. C. CABLE?"
"HOW CAN I SAFELY INCREASE THE LOAD ON MY PRESENT CABLES?"
"CAN WE PREVENT LEAD SHEATH CORROSION?"
"WILL OUR PRESENT 2" CONDUITS BE LARGE ENOUGH?"

IN OKONITE'S NEW V.C. CABLE MANUAL

If you haven't already received your copy, just write us on your company letterhead for Bulletin OK-1046. The Okonite Company, Passaic, New Jersey.

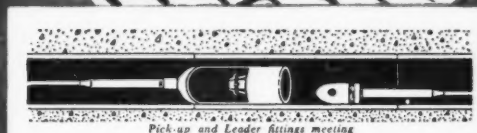
THE BEST CABLE IS YOUR BEST POLICY

OKONITE SINCE 1878 *insulated wires and cables*

7790

Electroline Duct Rodding

DOES IN THIRTY MINUTES WHAT USED TO TAKE TWO WEEKS



Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR

Utilities have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

Originated by Electroline — Always Ahead of the Field. Write for bulletins.

Electroline Company

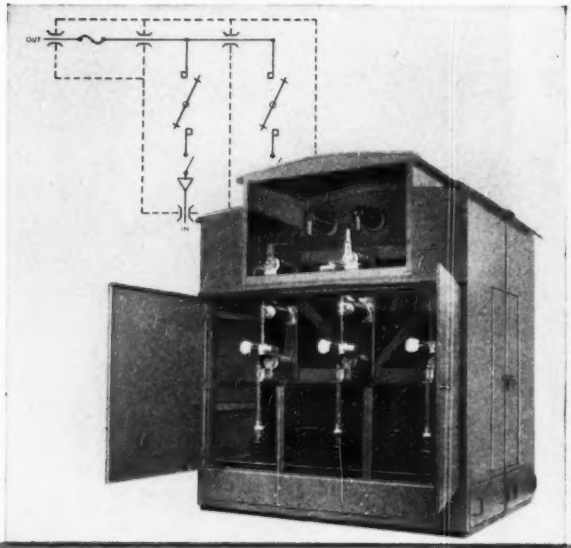
Originators and Patentees of Automatic Line Splices and Dead Ends

4121 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

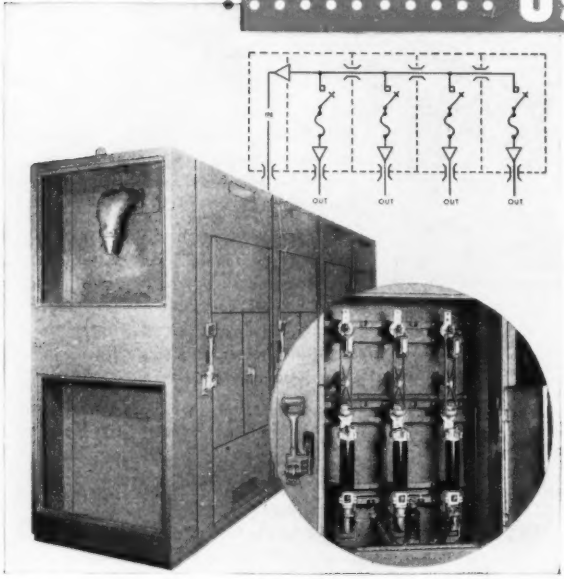
IN CANADA — **POWERLITE DEVICES, LTD., TORONTO**

WHERE HIGH VOLTAGE SWITCHGEAR MUST BE:

RELIABLE
ENCLOSED
PACKAGED
AND YET
LOW IN COST



USE S & C METAL-



Utilizing Alduti Interrupters and SM Power Fuses, S & C Metal-Enclosed Switchgear Units offer these important advantages:

- ***Large Savings in Equipment Costs*** as compared with circuit breakers, for Primary Switchgear, Secondary Switchgear, and Load Center Switchgear installations.

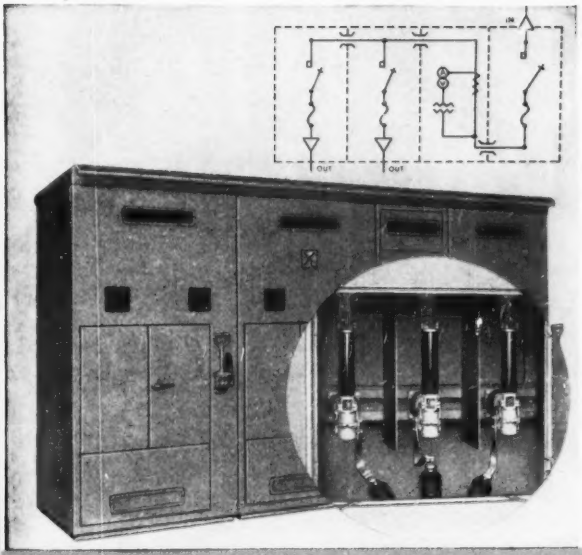
- ***Ease and Economy of Installation*** because all equipment within each unit—including meters, arresters, potheads, metering transformers, etc.—is factory assembled and connected. Incoming and outgoing connections are readily accessible.

CODE

Fuse
Disconnecting Switch
Lightning Arrester
Pothead
Meter
Through Bushing or wall opening
Potential Transformer
Current Transformer
S & C Alduti Interrupter Switch
Above 15,000 volts
15,000 volts and below

S&C ELECTRIC

Formerly SCHWEITZER & CONRAD, INC.



Typical Performance Characteristics of S&C Metal-Enclosed Switchgear Units:

● ***Load Current Switching***... up to 600 amperes on 2,300- to 33,000-volt circuits.

● ***Magnetizing Current Switching***... of transformer banks whose load currents are within the continuous current ratings of the switches, that is, to 1200 amperes on 2,300- to 13,800-volt circuits and 600 amperes above 13,800- to 33,000-volt circuits.

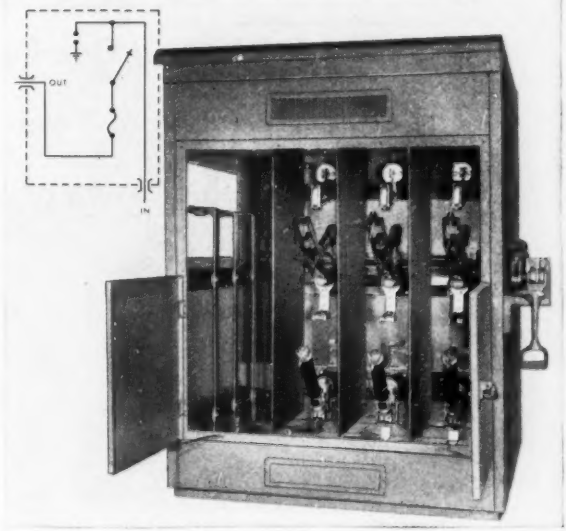
● ***Charging Current Switching***... of three phase capacitor banks of 2,000 kvar on 2,300-volt circuits; and 3,000 kvar on 4,160- through 13,800-volt circuits.

● ***Short Circuit Protection***... to 40,000 amperes, rms asymmetrical, on 2,300- and 4,160-volt circuits; 30,000 amperes on 13,800-volt circuits; and 20,000 amperes on 33,000-volt circuits. Or, stated in symmetrical 3-phase kva: 104,000; 180,000; 448,000; and 715,000 respectively. For higher short circuit interrupting ability, consult the factory.

ENCLOSED SWITCHGEAR UNITS

● ***Minimum Maintenance Expense*** since a blown fuse is fully restored by simple field replacement of its refill unit. Also, in the average application, the switches require just ordinary switch maintenance.

Shown here are typical units from regular production. Any special design can be made to meet your specific requirements. To get this modern, reliable, money-saving switchgear for your next installation — consult the telephone directory for the S&C representative in your city, or write us direct.



COMPANY

4421 Ravenswood Avenue
Chicago 40, Illinois, U. S. A.

In Canada, Powerlite Devices, Limited, Toronto

GET THIS *Premium*

New Allis-Chalmers Protected Transformers give you:

- ✓ Protection Against All Over-voltages and Surges
- ✓ Protection Against Overloads and Short Circuits
- ✓ Better Utilization of Transformer Capacity
- ✓ Signal Light Indication of Load Conditions

FOR MANY SYSTEMS, none but the most complete protection could be termed "adequate." This is especially true of well developed load areas where service continuity is highly important.

For these systems — both urban and rural — Allis-Chalmers ACP transformers give you the *complete* protection you need. In addition, they permit operating economies which can in themselves make the initial investment worthwhile. Here are the facts:

● **THEY'RE COMPLETE, PACKAGED UNITS.** As purchased, ACP transformers are totally self-protected against all types of electrical damage... lightning, short circuits, overloads.

● **SHORT TIME OVERLOAD CAPACITY IS FULLY UTILIZED** through coordination of internally mounted secondary breaker and temperature rise of high voltage and low voltage coils. It means that transformer can safely be loaded much closer to actual thermal limit of windings (see chart).

● **SYSTEM CONTINUITY IS INCREASED** because load can be held to last safe limit before removing customer service (breaker is actuated by *either* or *both* load current and oil temperature); also, internal high voltage fuse links function to isolate transformer in event of internal fault without affecting rest of line.

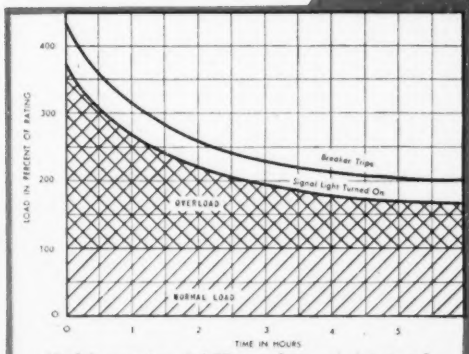
● **SIGNAL LIGHT INDICATES** when transformer temperature approaches danger load . . . stays lit to provide a convenient, permanent check on system. Breaker can be reset safely and easily with hookstick.

FOR details on premium ACP transformer protection, or other Allis-Chalmers protective systems, contact your nearby A-C sales office. Or write direct. A-2832

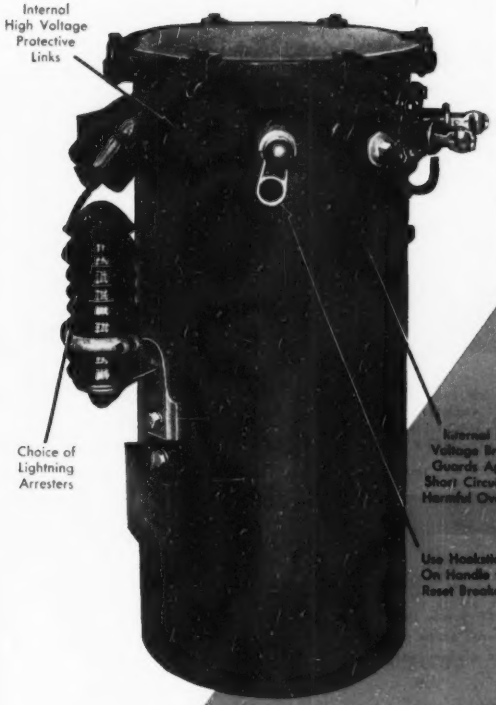
ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-

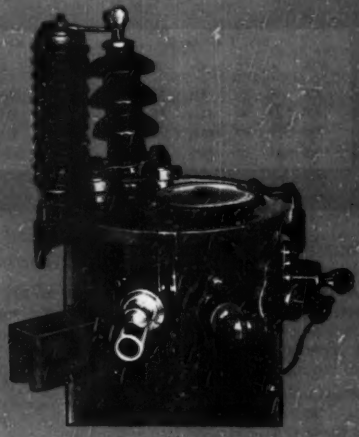
PROTECTION!



Useful capacity of ACP transformer is increased with secondary breaker, actuated by either or both load current and oil temperature.


Internal High Voltage Protective Links
Choice of Lightning Arresters
Internal Low Voltage Breaker Guards Against Short Circuits and Harmful Overloads
Use Hookstick On Handle to Reset Breaker

URBAN TYPE



RURAL TYPE

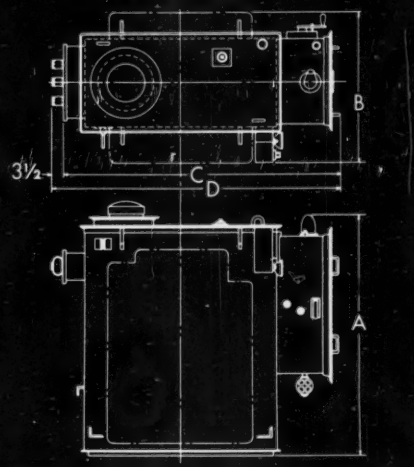
CHALMERS

A-C ALLIS-CHALMERS

ALLIS-CHALMERS NETWORK TRANSFORMERS

Fit Any System Needs!

DIMENSIONS



TYPES

Both vault and subway types; either oil, or *Chlorextol**-Liquid cooled.

	H.V. 5 KV CLASS					H.V. 15 KV CLASS			
KVA	A	B	C	D	KVA	A	B	C	D
300	60	37	67½	71	300	60	38	70½	74
500	65	40	74½	78	500	65	40	77½	81
750	76	42	80½	84	750	76	42	81½	85
1000	85	50	83½	87	1000	85	51	86½	90

RATINGS

300 kva 500 kva 750 kva 1000 kva

Available in H.V. Ratings 5 kv 15 kv 22 kv 33 kv

5 kv and lower — no taps (taps available at additional cost)

7200 v to 33,000 v — (4) 2½% taps below normal

L.V. 216Y/125, 4 Wire (standard)

199Y/115, 208Y/120, 213Y/123 (optional)

YOUR SYSTEM REQUIREMENTS can be met economically with Allis-Chalmers standardized Network Transformers. Special engineering is eliminated in most cases because *standard* A-C units, without modification, meet most system requirements.

Standardization of dimensions, and standard location of important accessories make it easy to interchange sizes in the event of future expansion.

Where required, modifications will be made to fit special system needs.

Get complete information by writing for bulletin 61B6152A. Or contact your nearby A-C sales representative.

ACCESSORIES

FLUSH TYPE LIQUID GAUGE is easy to read. High impact strength tempered gauge glass is given additional protection of heavy bronze cover.

THERMAL INDICATOR shows operating temperature as well as maximum reading . . . is specially gasketed for complete water-proofing.

AIR TEST VALVE with spring-actuated, self-closing arrangement gives positive protection against infiltration of foreign material.

LIQUID SAMPLING DEVICE used on *Chlorextol**-Liquid filled transformers is hand rotated to enable sample to be taken at liquid level.

TOP FILTER PRESS VALVE is located near drain valve for convenience. Internal connection is piped to diagonally opposite corner of tank, providing a cross flow to assure complete interchange of liquid.

RELIEF DIAPHRAGM on cover of *Chlorextol**-Liquid filled transformer protects transformer in the event of abnormal operating pressure.

COMPLETE DRAIN VALVE and bottom filter press connection. Special valve design permits accurate liquid sampling. A-2097

ALLIS-CHALMERS, 932A SO. 70 ST. MILWAUKEE, WIS.

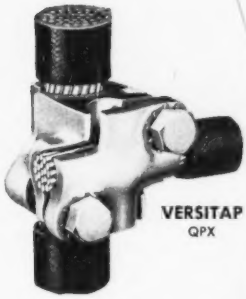
*Non-inflammable insulating liquid.

Chlorextol is an Allis-Chalmers trademark.

ALLIS-CHALMERS

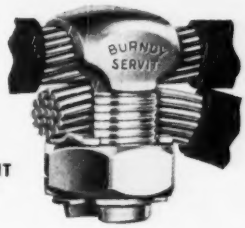
Network Transformers—Nearly 1,000,000 KVA Installed

You're Well Connected with BURNDY



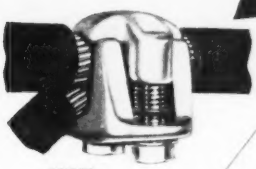
VERSITAP
QPX

QIKLUG
QA

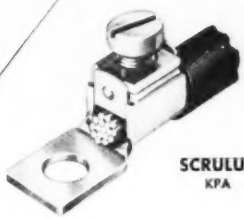


SERVIT
KS

HERE'S WHY



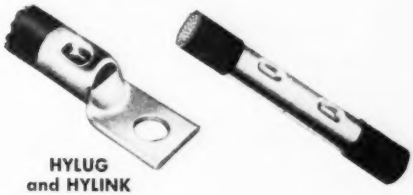
OKLIP
KVS



SCRULUG
KPA

They're designed with *you* in mind. Each connector, whether it be a tap, terminal or splice, is especially engineered for its specific job. Without fuss or fumble, each Burndy connector is installed quickly and simply. With a few sizes and types you can do almost any connecting job.

Because they are easier to work with and because they are both mechanically and electrically superior, Burndy connectors are preferred among contractors and industrial maintenance men. Catalog 52 completely describes Burndy connectors. You'll find it handy, so send for a copy today. When you're on the job, *connect with Burndy.*



HYLUG
and HYLINK

Connect with
BURNDY

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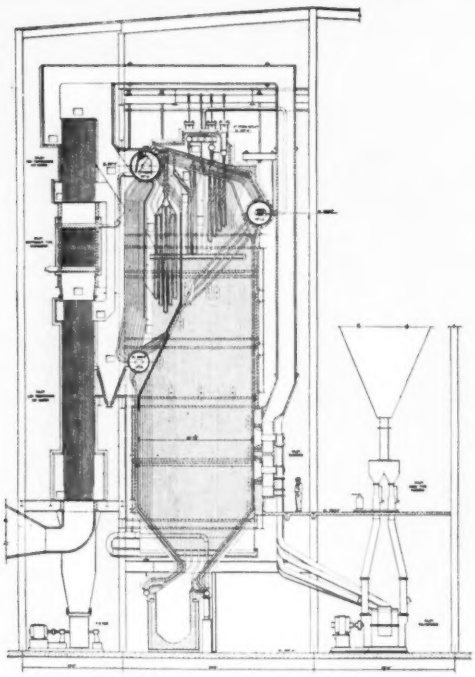
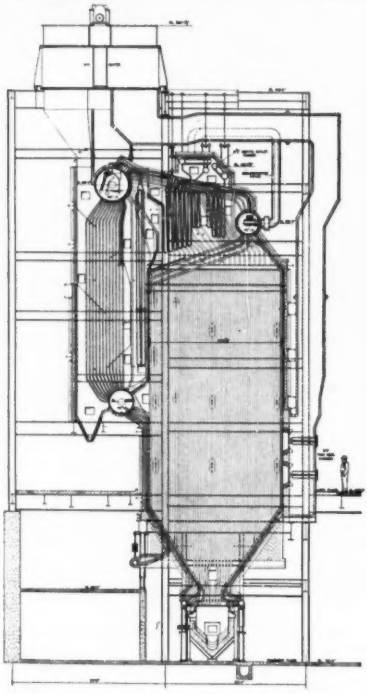
Western Branch: Vernon 11, California • *Canada:* BURNDY CANADA, LTD., Toronto 8

A Few Recent RILEY



NORTHERN VIRGINIA POWER CO., Riverton Station
350,000 lbs./hr. 1050 lbs. 900°F.
Sanderson & Porter, Engineers

PUBLIC SERVICE CO. OF INDIANA, Edwardsport, Ind.
400,000 lbs./hr. 1000 lbs. 910°F.
Sargent & Lundy, Engineers
Public Service Co. of Indiana is also installing
Riley Units in their Dresser and Noblesville plants



All of these Public Utilities have recently ordered Riley Steam Generating Units

HOUSTON LIGHTING & POWER CO.
West Junction Station, 2—850,000 lbs./hr.
Gable Street Station, 1—350,000 lbs. hr.
Greens Bayou Station, 2—675,000 lbs./hr.

CENTRAL OHIO LIGHT CO.
Bluffton Station, 1—120,000 lbs./hr.

UPPER MICHIGAN POWER & LIGHT CO.
Escanaba Station, 1—150,000 lbs./hr.

GULF POWER COMPANY
Pensacola Station, 2—230,000 lbs./hr.

PUBLIC SERVICE CO. OF INDIANA
Dresser Station, 1—300,000 lbs. hr.
Noblesville Station, 3—300,000 lbs./hr.
Edwardsport Station, 2—400,000 lbs./hr.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Davenport Station, 3—250,000 lbs. hr.
Iowa City Station, 1—60,000 lbs./hr.

INTERSTATE POWER CO.
Lansing Station, 2—120,000 lbs. hr.
Fox Lake Station, 2—120,000 lbs./hr.

WORCESTER COUNTY ELECTRIC CO.
Webster Street Station, 1—325,000 lbs. hr.

TRADE MARK Rx REGISTERED

RILEY

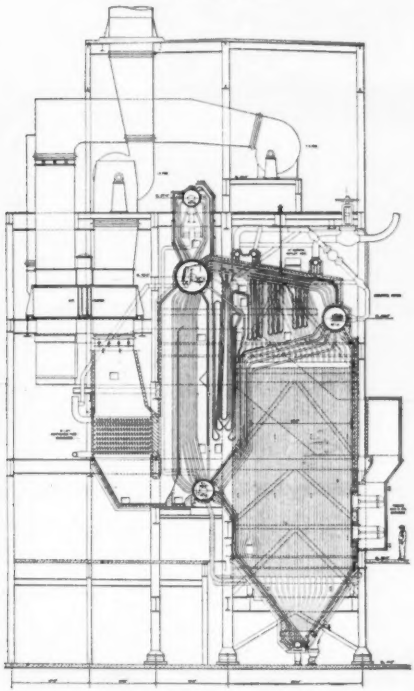
STOKER CORPORATION, WORCESTER, MASS.

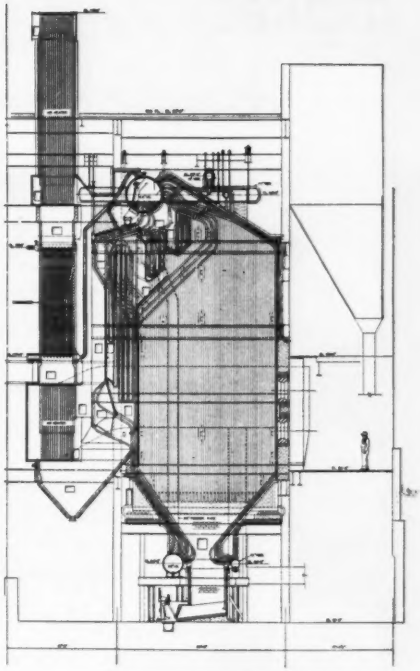
Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

Central Station Units

City of Los Angeles, Calif., Harbor Steam Plant
825,000 lbs./hr. 1200 lbs. 900°F.
With the addition of these three units, Harbor Steam Plant will have 3,825,000 lbs. of steam capacity of Riley Units





Central Illinois Light Co., Peoria, Ill.
(Commonwealth & Southern Corp.)
300,000 lbs./hr. 925 lbs. 900°F.
With the installation of these two units, Central Illinois Light Co. will have four Riley Steam Generating Units in this station

Otter Tail Power Co.
Devils Lake Station, 1—75,000 lbs./hr.
Crookston Station, 2—75,000 lbs./hr.
Wahpeton Station, 1—100,000 lbs./hr.
Hoot Lake Station, 1—160,000 lbs./hr.

Southwestern Public Service Co.
Borger, Texas, 1—330,000 lbs./hr.

New Orleans Public Service Co.
Market Street Station, 1—330,000 lbs./hr.

South Carolina Power Co.
Charleston Station, 2—230,000 lbs./hr.
1—310,000 lbs./hr.

Central Illinois Light Co.
Peoria Station, 2—300,000 lbs./hr.
1—600,000 lbs./hr.
Springfield Station, 1—125,000 lbs./hr.

Arkansas Power & Light Co.
Cecil Lynch Station, 1—650,000 lbs./hr.

Utah Power & Light Co.
Orem Station, 1—450,000 lbs./hr.
Jordan Station, 1—620,000 lbs./hr.

Mississippi Power Co.
Hattiesburg Station, 3—230,000 lbs./hr.

Ohio Edison Co.
Mad River Station, 1—250,000 lbs./hr.
Beech Street Station, 1—90,000 lbs./hr.

Northern Virginia Power Co.
Riverton Station, 1—350,000 lbs./hr.

City of Los Angeles
Harbor Steam Station, 3—825,000 lbs./hr.

Union Electric Co. of Missouri
Ashley Street Station, 3—310,000 lbs./hr.

West Penn Power Co.
Milesburg Station, 2—210,000 lbs./hr.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your fuel cost

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

How the Alchlor Process makes GULFCREST a superior turbine oil —

1. The Alchlor Process is an extra refining step—weeds out more sludge-forming hydrocarbons than any other refining method.

2. The Alchlor Process imparts a greater ability to benefit from special inhibitors that control oxidation and prevent corrosion.

3. Result: An outstanding oil with long life and unmatched performance records.

In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining most other turbine oils — but has not yet been Alchlor-processed.

In Cylinder 2 you see the part—approximately 15% — discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

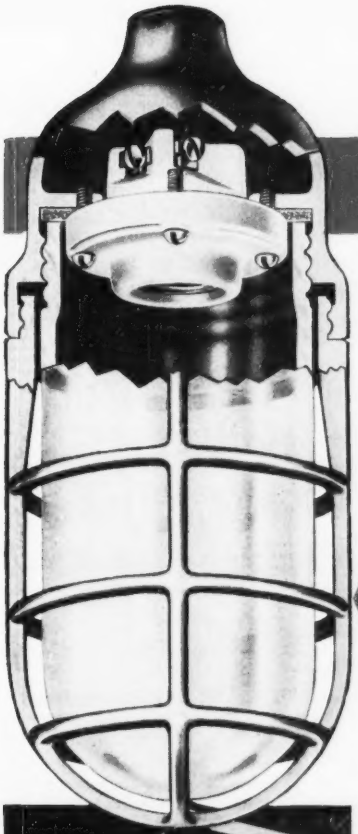
GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

Vaportight
Industrial Lighting
CONDULET*



For use in boiler rooms, powerhouses, shower rooms, tunnels, loading docks, building entrances, and all indoor and outdoor locations where exposed to moisture and rain, non-explosive vapors and gases, or non-combustible dusts.

Vaportight and raintight.

Wiring chamber remains vaportight even though globe is off.

Porcelain Receptacle.

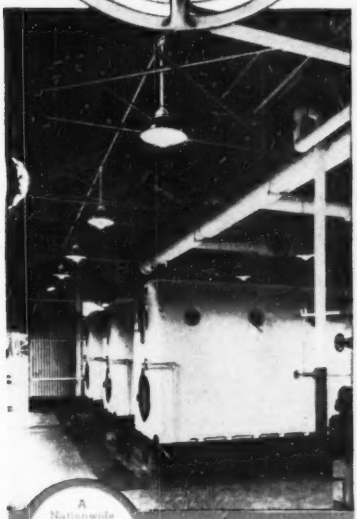
Screw guard or clamp guard.

11 Hub arrangements.

4 Reflector styles.

Accessories: Colored globes, pear-shaped globes and guards, half shades, and adapters.

4 Sizes: 50 through 500-Watt.



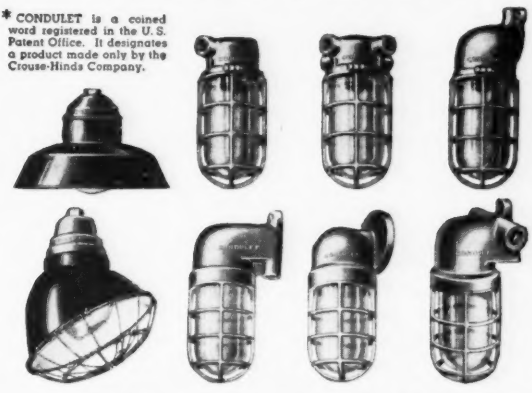
A Nationwide Distribution Through Electrical Wholesalers

CONDULETS
FLOODLIGHTS
TRAFFIC SIGNALS
AIRPORT LIGHTING

Vaportight lighting fixtures are available for attaching to several round-base Condulets and sheet steel outlet boxes. Crouse-Hinds complete *Vaportight* line includes hand lamps, switches, plug receptacles, and other electrical devices.

Complete listings in Section 25, Condulet Catalog 2500.

* CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.



CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham – Boston – Buffalo – Chicago – Cincinnati – Cleveland – Dallas – Denver – Detroit Houston – Indianapolis – Kansas City – Los Angeles – Milwaukee – Minneapolis – New York Philadelphia – Pittsburgh – Portland, Ore. – San Francisco – Seattle – St. Louis – Washington. *Resident Representatives:* Albany – Atlanta – Charlotte – New Orleans – Richmond, Va.
CROUSE HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

Jack of ONE trade

—and MASTER of it!

CORNELL-DUBILIER

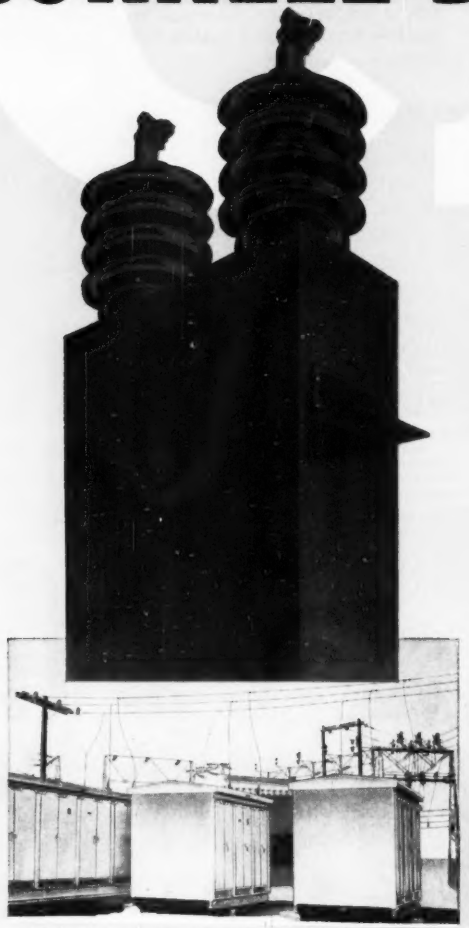


Photo showing section of a 37,640 Kvar, 12,470 Volt, WYE, isolated neutral, station-type C-D capacitor installation.

THE POWER-FACTOR CAPACITOR SPECIALIST FOR UTILITIES

More than a decade ago, C-D installed its first power-factor capacitor installation. It's given trouble-free service ever since. During the intervening years C-D capacitors have rolled up a record of better than 10-years average service on utility systems and in manufacturing plants throughout the world. Specialization has enabled us to produce a better power-factor capacitor.

Our engineers will be glad to discuss with you the advisability of a capacitor designed for your specific needs. Your inquiry is cordially welcomed. Cornell-Dubilier Electric Corporation, Dept. D119, South Plainfield, New Jersey. Other plants in New Bedford, Worcester, Brookline, Mass.; Providence, R. I.; Indianapolis, Ind. and Cleveland, O.

Follow the leaders

Demand dependable C-D Capacitors —built by capacitor specialists.

CORNELL-DUBILIER CAPACITORS CD

1910 1949

Reg. U. S. Pat. Off.

C-D Best by Field Test!

CORNELL-DUBILIER WORLD'S LARGEST MANUFACTURER OF CAPACITORS

Operating board of a 4-unit station. Normally all 4 are on base load during day; two units usually regulate frequency as the evening peaks develop. As peaks fall, units go to reduced base load and another station takes over regulation. In morning, regulation comes back in approximate reverse. Station often handles emergency regulation during day; system operator, 100 miles away, uses its individual units as he wishes to increase system efficiency.

MULTI-UNIT LOAD-FREQUENCY CONTROL IS CUTTING KW COST

Economy-minded managers in several power companies are now digging into the newer efficiency angles of load-frequency regulation. In routine system regulation, which maintains minute-by-minute balance between generation and consumer load, these engineers suspect there lie untapped opportunities for further savings.

Basically, of course, the regulating problem is to allocate load-frequency control for maximum *system* (as distinguished from *station*) efficiency. And the allocation naturally varies with the load; at one load level Units A and B may be best; at another level it may be Units E and G, and L, in stations miles apart.

These flexible conditions mean that an electric company should be able to pick and choose, not only among stations, but among the generating units in the stations. Operators should be free to put the load-frequency regulation wherever the existing load, considered in respect to the unit efficiencies, can be carried at the best system efficiency.

Planned Regulation Costs Less Than Haphazard

To attain this efficiency, it's usually advisable to employ automatic regulation. If a company already uses L&N equipment for other load-frequency problems, it probably will need only a little more to equip each Unit with its own controller. Then complex regulating schedules do not matter. The operators can set a few dials and switches, and assure highest feasible efficiency.

For further information, ask for a copy of Technical Publication N-56-161(1). Leeds & Northrup Co., 4938 Stenton Ave., Philadelphia 44, Pa.

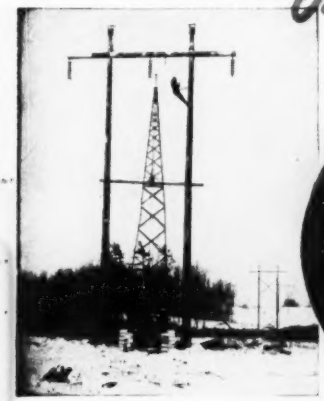
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl Ad ND56-161(1)

Your PORCELAIN PRODUCTS' Suspension Insulator...

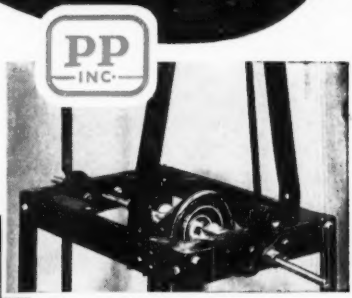
the best Power Salesman on Your Payroll

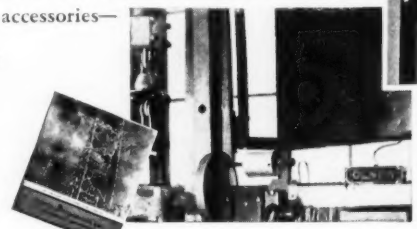


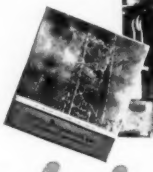
You sell power when your lines stay up. One "weak link" in your insulator chain can black out whole communities, resulting in unsatisfactory customer relationships, the cost of which cannot be computed, in addition to the cost of repairs and the loss of revenue. PORCELAIN PRODUCTS' Suspension Insulators keep selling for you because they give continuous, trouble-free performance. They're compression glazed for added toughness, and designed to withstand unusual strain of wind and ice loads. Built to rigid manufacturing standards, like those illustrated, assure perfect performance in service. Next power job, specify PORCELAIN PRODUCTS, and see what a "power salesman" you've hired. For other PORCELAIN PRODUCTS' High Voltage Insulators and accessories—

PINTYPES, CUTOUTS SPOOLS, STRAINS, CLEVISES, RACKS, WIREHOLDERS

Write for Your Copy of Catalog 10-A





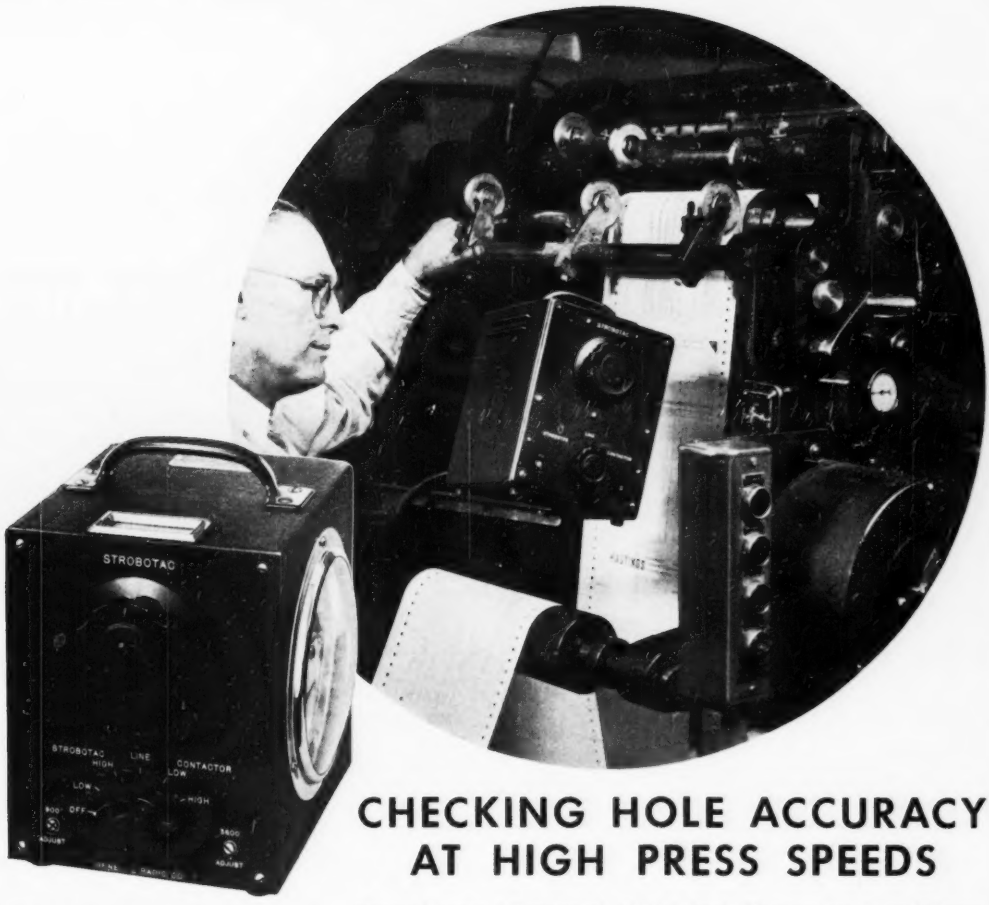


Above—Laboratory measured impact tests verify the fact that your P.P. Suspension Insulators can *"take it"*.

Left—C—Combined mechanical electrical strength test proves the stamina of Porcelain Products Suspension Insulators.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA



STROBOTAC

Type 631-B

Flashing Speed Range: from 600 to 14,400 per minute, calibrated to read directly in rpm. Upper speed limit 100,000 rpm

Flash Durations: between 5 and 10 *millionths* of a second.

Power Supply: 115 volts, 60 cycles

Power Input: 25 watts.

Dimensions: $7\frac{1}{2}$ x $8\frac{3}{4}$ x $9\frac{7}{8}$ inches

Price: $125.00, ready to operate

CHECKING HOLE ACCURACY AT HIGH PRESS SPEEDS

Bonnar-Vawter, Incorporated, of Cleveland, Ohio, writes us as follows:

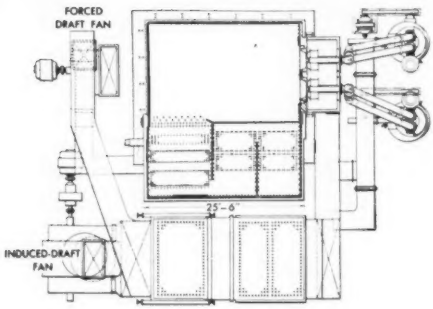
"We operate rotary presses which print from a roll of paper and rewind the paper in the form of a roll on the delivery end of the machine. On the machine, which does the printing of the forms, we also perform perforating and punching operations. It is necessary to maintain accuracy in location of the punch holes to the printing. Inasmuch as the printing presses run at high speeds, it is impossible to observe the position of the punch holes in relation to the printing without the assistance of the Strobotac."

Here as in hundreds of instances, the Strobotac accurately measures the speed of moving parts inaccessible to other methods. By "stopping motion," the Strobotac flash (5 to 10 microseconds) reveals conditions and causes, effects and defects, previously hidden or obscured.

Write for your 24 page manual of stroboscopic techniques, "Eyes for Industry."

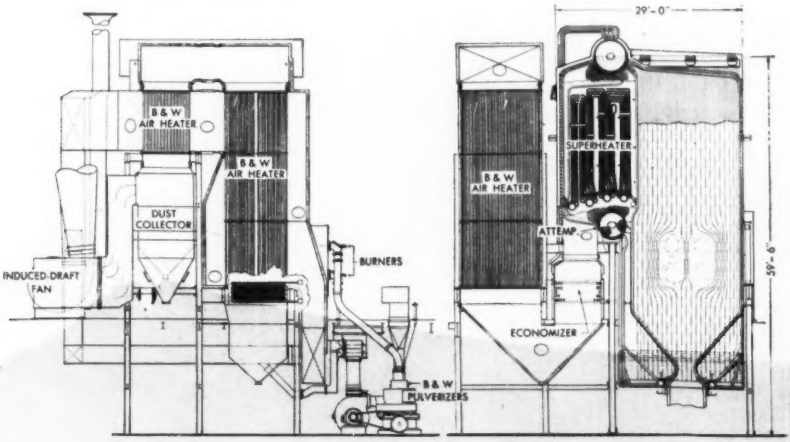
GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 920 S. Michigan Ave., Chicago 5 1000 N. Seward St., Los Angeles 38



ANOTHER *Solo*

. . . Hudson Plant—



New Hudson Plant boiler which supplies steam at 850 psig and 900F to a 20,000 kw. turbine. Two B&W Pulverizers feed four coal burners. Final steam temperature is closely controlled by an attemperator in the lower boiler drum.

B&W

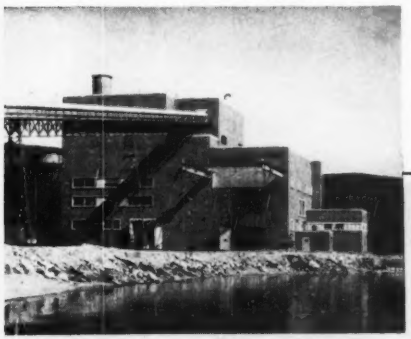
BABCOCK & WILCOX

Performance FOR B&W STEAM

Rockland Light and Power Co.

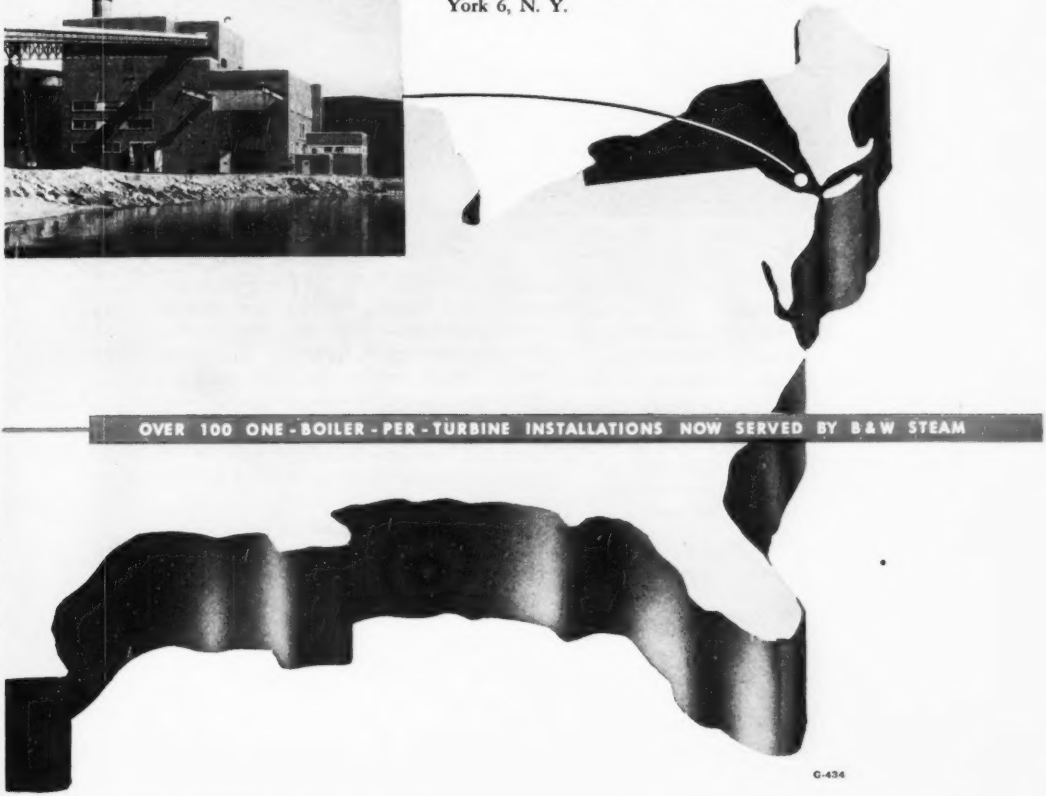
Steam for the first 20,000 kw. unit at the new Hudson Plant of Rockland Light and Power Co., Tomkins Cove, N. Y., is supplied by a single B&W Integral-Furnace Boiler, Type FH. Details of this new 200,000 lb. per hr. pulverized-coal-fired unit are illustrated on the opposite page. A duplicate unit is now on order for this station.

Advantages of this standardized boiler design contributed importantly to success of the Power Company and consultants, Burns and Roe, Inc., in keeping down initial costs of the Hudson Plant, as well as simplifying its operation and maintenance.

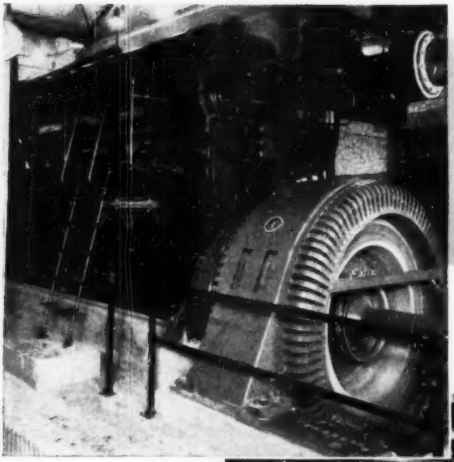


More and more power companies are finding the B&W Integral-Furnace boiler, Type FH, the best buy for steam requirements up to 350,000 lb. per hr., and for outdoor as well as conventional installations.

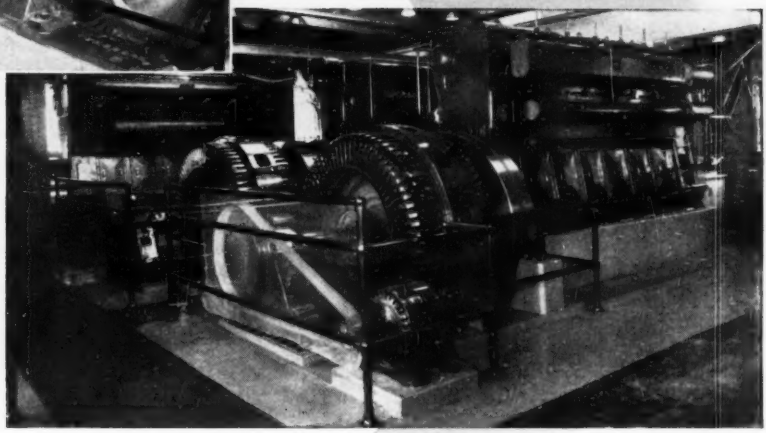
Write for Bulletin G-38 describing this popular unit. The Babcock & Wilcox Co., 85 Liberty Street, New York 6, N. Y.



G-434



Gold is where you find it



● Seven Superior Diesels helped a midwest quarry company find gold—gold in the form of reduced power costs. In only 12 years the use of Diesels reduced the cost of electrical power $156,000, *after all expenses, including depreciation, were deducted!*

But Superior Diesels supplied more than a low cost source of power—they also provided a dependable one. The engines are operated *at least 16 hours daily, 6 days a week, 52 weeks a year!*

Over and over again we hear similar reports about the outstanding performance provided by Superior Diesels. But that's not strange when you consider that Superior has all of the following advantages: Conservative Ratings • Fuel Economy • Precision Bearings • Heavy Rigid Crankshafts • Strong Bases and Cylinder Blocks • Proved Roller Chain Camshaft Drive • Oil Cooled Pistons.

Superior Diesels may be able to help you get gold from your power costs. We would like to discuss it with you—just drop us a line and tell us when it's convenient for you.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESEL

—you'll find what you need in the Complete line

These pictures will give you an idea of the wide variety offered in the Penn-Union Catalog:

Grounding connectors, clamps, and studs for all combinations of pipe, rod, flat bar, braid, tubing.

Every one a thoroughly tested, dependable unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.

Penn-Union also makes the *complete* line of Service Connectors, Power Connectors, Tees and Cable Taps, Straight and Parallel Connectors and Reducers, Terminal Lugs, etc.

Penn-Union fittings are the first choice of leading utilities, industrial corporations, electrical manufacturers and contractors—*because of their known dependability.*

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION

Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

THE Complete LINE OF CONDUCTOR FITTINGS

PENN-UNION

Which meets your system requirements?

coordinated substations?

For overhead subtransmission circuits

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

WESTINGHOUSE

MODERN EQUIPMENT FOR BETTER DISTRIBUTION SYSTEMS

. . . . unit substations?

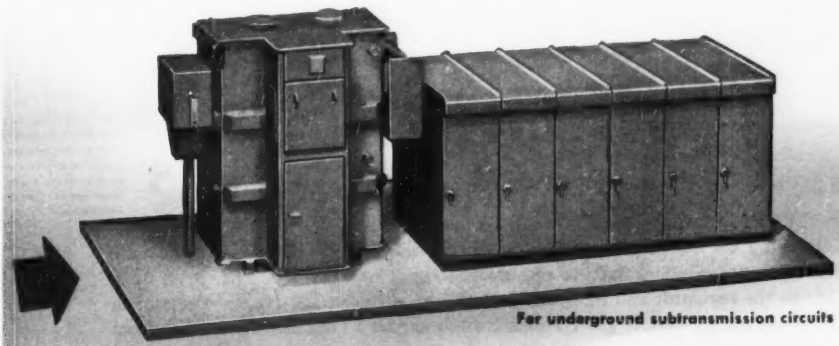
Today, *modern* substations for any system requirement may be purchased in two basic forms . . . as *Unit Substations* or *Coordinated Substations* . . . both supplied by Westinghouse.

Westinghouse helped introduce the *Unit Substation.* This type of substation is designed, built, tested and shipped complete . . . ready for connection to your system. Briefly, a *Unit Substation* consists of a transformer, and the necessary switchgear, combined to form an articulated unit to which the subtransmission and primary feeder circuits can be directly connected.

The *Coordinated Substation* consists of one or more *Unit Substations* with complete overhead terminating structure and any necessary terminating facilities. This equipment is shipped in easily-installed, factory-assembled and prefabricated sections.

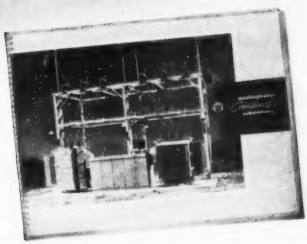
Westinghouse can supply a complete substation in *any* form . . . from incoming line to outgoing feeder . . . for *any* system. Whatever your power distribution requirements may be . . .

YOU CAN BE **SURE**
IF IT'S Westinghouse



For underground subtransmission circuits

Here's the Complete Story **ON WESTINGHOUSE COORDINATED SUBSTATIONS!**

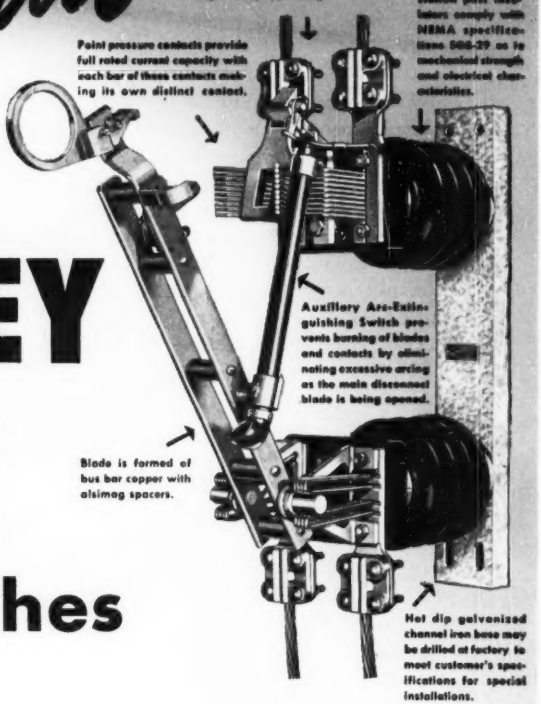


This 86-page book presents the standardized Westinghouse line of Coordinated Substations. Fact-filled pages of photographs and line diagrams give you complete information on all types . . . covering all basic requirements from the simplest to the more involved types of distribution substations.

To get your copy, call your nearest Westinghouse office. Ask for booklet B-4061 or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-97132

Safe Switching Sequence is *Automatic* with KEARNEY Regulator By-Pass Switches


Terminals are constructed of high conductivity copper alloy featuring a clamp type design.
3-inch bolt circle station post insulators comply with NEMA specifications 568-29 as to mechanical strength and electrical characteristics.
Point pressure contacts provide full rated current capacity with each bar of these contacts making its own distinct contact.
Auxiliary Arc-Extinguishing Switch prevents burning of blades and contacts by eliminating excessive arcing as the main disconnect blade is being opened.
Blade is formed of bus bar copper with alsimag spacers.
Hot dip galvanized channel iron base may be drilled at factory to meet customer's specifications for special installations.

Eliminate the hazards of opening the wrong disconnect. Pull *one* ring and take care of four distinct switching operations — by pass the main line, open both leads to the regulator and interrupt the exciting current. Restore the regulator in service simply by closing the By-Pass Switch as you would any other disconnect switch. Simple, safe and entirely automatic.

JAMES R. KEARNEY CORPORATION 4224-42 Clayton Avenue, St. Louis 10, Mo.
Canadian Plant • Guelph, Ontario

Always Specify JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *for the Job...*

142

Better Construction — *SAFER* Maintenance

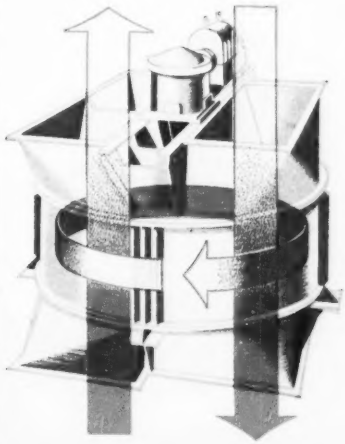
Fact File on Preheat

No. 5

In the Ljungstrom air preheater the compact arrangement of rotating heat transfer elements assures maximum heat recovery for its size and weight.

The higher recovery possible with the regenerative feature more than compensates for the small amounts of air that pass to the gas side of the heater by entrainment in the moving rotor and at the seals. This passage of air is predictable and consistent during the life of the plant with allowance being readily made in the initial selection of the preheater and fans.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of leading power plants and other special applications confirm its high level of heat recovery and long-term low maintenance service.

THE

AIR PREHEATER CORPORATION

60 EAST 42ND STREET • NEW YORK 17, N. Y.

Plant: Wellsville, N. Y. 2410

There's no variation in the high quality of U·S·S Creosote Oil

● That's why you always get the best results when you specify U·S·S Creosote Oil — whether you operate your own treating plant or purchase treated poles and crossarms.

Batching of U·S·S Creosote Oil is a continuous process at United States Steel's tar distillation plant—the largest in the world. As a result, U·S·S Creosote Oil is a uniform product, made to give you uniformly good results every time it's applied.

Consistently-high quality is only one of the advantages of specifying creosote oil made by United States Steel, the industrial family that serves the nation. The extent of U. S. Steel's operations makes prompt delivery possible, no matter where the plant that does your treating is located.

If you'd like more information about creosote oil, the truly time-tested preservative, write us. There's no obligation.

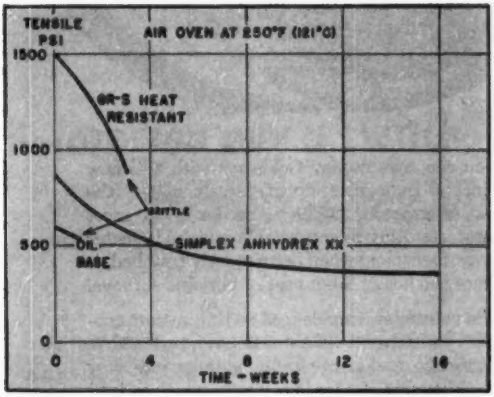
COAL CHEMICAL SALES DIVISION
United States Steel Corporation Subsidiaries
71 Broadway, New York 6, N. Y.

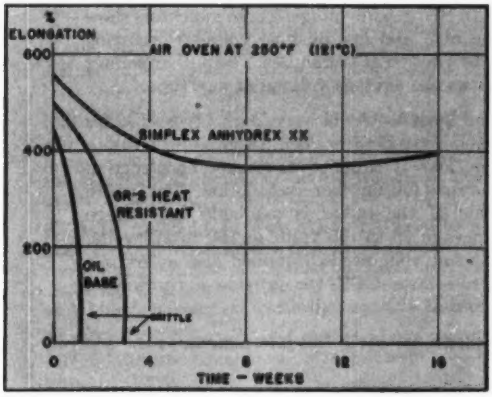
USS

CREOSOTE OIL

UNITED STATES STEEL

AGED AT 250°F





. . . YET THE NEW ANHYDREX XX PROVES ITSELF "TOPS" AMONG HIGH-VOLTAGE INSULATIONS!

Yes, at 250 F., and after SIXTEEN weeks of constant exposure to this grueling temperature the new Anhydrex XX insulation was still rubber-like in quality and appearance; still suitable for continued use. It had retained approximately half of its tensile strength, nearly two-thirds its elongation. **And after the first few weeks the rate of deterioration was very slight,** indicating exceptional stability and long life.

Conventional oil base and GR-S heat-resistant compounds undergoing the same test could not match its performance. At the end of only one week the oil base compound had completely lost its rubber-like characteristics. Two weeks later the GR-S compound followed suit. Both had become brittle and, upon bending, immediately cracked and crumbled.

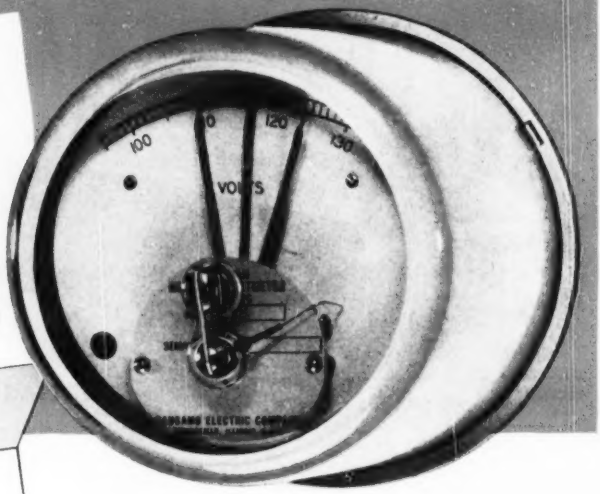
After aging for 7 days under the same high temperature, Anhydrex XX was immersed for a week in distilled water at 70 C. (158 F.) yet would not absorb more than 15 mg. per square inch of exposed surface. It was exposed to .03% ozone for four hours yet would not crack when bent.

Yes, Anhydrex XX is the only high-voltage insulation that combines low water absorption with long life, ozone resistance and heat resistance. It is your assurance of low-cost, uninterrupted service under all operating conditions. For complete data, write us today for Specification 1685.

SIMPLEX WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

LINCOLN
Type V-2S
(MAXIMUM-MINIMUM) indicating voltmeter



Valuable New Aid in Voltage Control

Saves Man-Hours Required by Periodic Surveys

Provides Continuous Information

You can save money two ways with this new Lincoln Indicating Voltmeter. It makes the use of graphic meters unnecessary in most cases, resulting in appreciable savings in meter investment; and when permanently installed, it saves the heavy labor cost of periodic surveys.

The voltmeter, time-lagged so that instantaneous values are not shown, is equipped with a maximum and a minimum voltage indicator on either side of a pusher pointer which is fixed to the actuating element of the meter. The pusher pointer spreads the indicators apart with changes in voltage. These indicators show the high and low average voltages occurring over a period of 10 minutes. The pusher pointer shows the average voltage at any time.

The Type V-2S will withstand surges of 12 kv level, is temperature compensated for outdoor use, and is supplied in socket construction suitable for outdoor installation. The entire scale of the meter is available for voltage ranges of 95 to 135 volts, or 190 to 270 volts, to meet your needs. Supplied also in graphic form—Type CCV—to provide a continuous *record* of average voltage.

Bulletin 483 gives full information.

50TH ANNIVERSARY SANGAMO 1899 - 1949

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

R&IE

NEW type TTR-49

69 Kv.
600 AMP.

Before you buy a switch that gives you less...

CHECK the FACTS!

THE NEW TTR-49 WAS DESIGNED WITH YOUR PRESENT DAY INCREASING OPERATING PROBLEMS IN MIND

1 **JAW CONTACT**—Hi-Pressure, Hi-Thermal capacity silver to copper contact. ONLY ONE BREAK CONTACT on the switch. Copper and beryllium jaw—copper for thermal capacity and beryllium for strength and resilience. Here's maximum protection against fault current damage.

2 **HINGE CONTACT**—Completely enclosed and weather sealed Hi-Pressure, Hi-Thermal capacity, silver to copper Hinge Contact. Continuous, annular, constant electrical and mechanical contact at all times. Eliminates second break contact with its multiplied problems and maintenance.

3 **BLADE OPERATING MECHANISM**—Simplified and "streamlined" to attain a simple harmonic, accurately controlled blade motion. Special pin fastenings, snap rings, and rivets have been eliminated from moving parts. Universal blade balance on 69 Kv. and above.

4 **BLADE**—Extra heavy, hard drawn tubular copper with integral, formed contact end. Solid current path from jaw to hinge contact.

5 **TERMINALS**—Four half-inch bolts on 1¾ x 1¾ inch centers permit NEMA standard 600 or 1200 Ampere clamping and R&IE Type "UC" universal clamps. Both terminals equal height from base.

6 **BEARING**—Aluminum housed, weather-sealed, stainless ball—requires no lubrication.

RAILWAY and INDUSTRIAL ENGINEERING CO.
GREENSBURG, PA.

IN CANADA—
EASTERN POWER DEVICES
LIMITED, TORONTO
An I-T-E ORGANIZATION

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

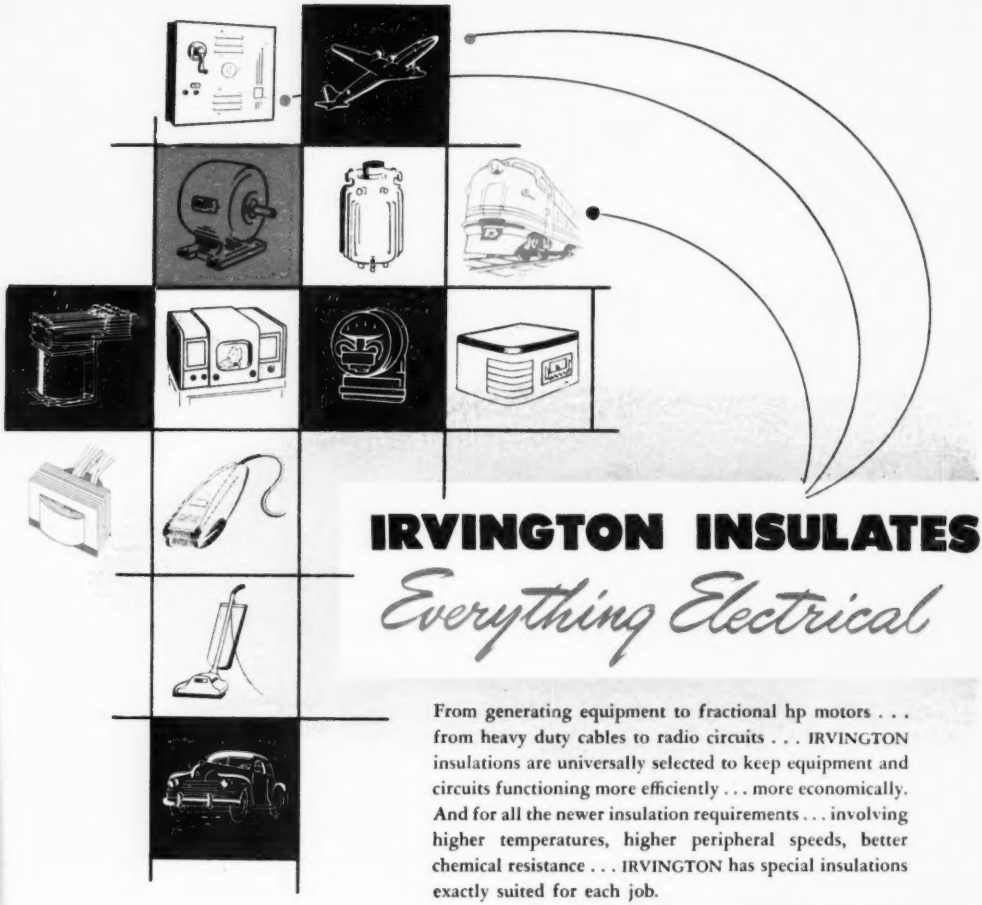
OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES



IRVINGTON INSULATES

Everything Electrical

From generating equipment to fractional hp motors . . . from heavy duty cables to radio circuits . . . IRVINGTON insulations are universally selected to keep equipment and circuits functioning more efficiently . . . more economically. And for all the newer insulation requirements . . . involving higher temperatures, higher peripheral speeds, better chemical resistance . . . IRVINGTON has special insulations exactly suited for each job.

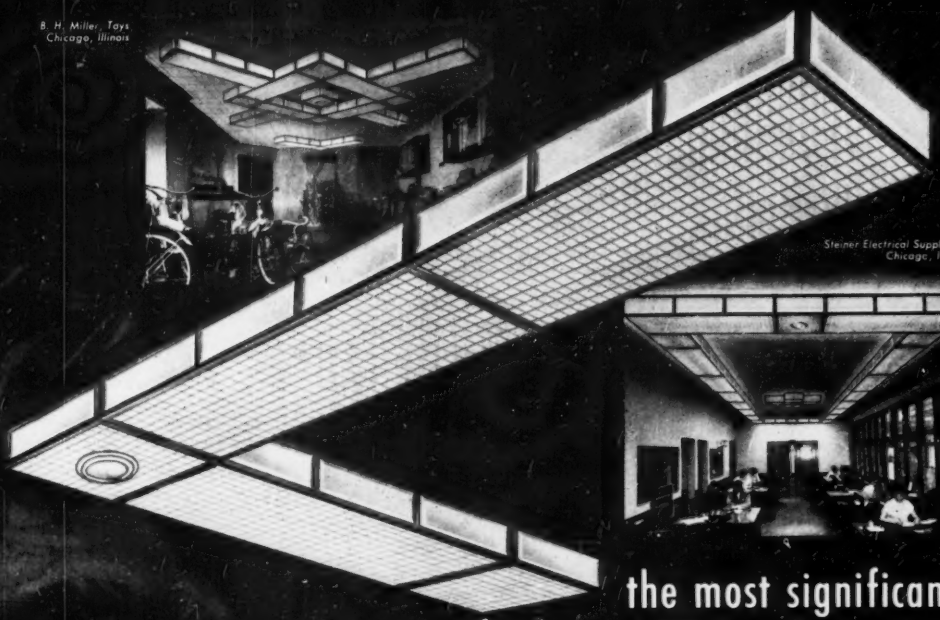
A partial list of IRVINGTON product groupings is given below; complete literature as well as generous samples of any IRVINGTON insulation gladly furnished on request.

Look to Irvington
for Continued Leadership in Insulation"

- **VARNISHED CAMBRIC and TAPE**
- **VARNISHED CANVAS**
- **VARNISHED SILK, NYLON, RAYON**
- **INSULATING PAPERS**
  Varnished, Asbestos, Acetate Coated
- **ADHESIVE BACKED YELLOW VARNISHED CAMBRIC**
- **SLOT INSULATIONS**
  All Combinations for Class A, B and H Insulation
- **FIBERGLAS INSULATIONS**
  Varnished Coated
  Silicone Coated
  Silicone and Mica Combinations
- **VARNISHED TUBINGS and SLEEVINGS**
- **FLEXIBLE EXTRUDED PLASTICS**
  In all shapes, thicknesses, colors
- **INSULATING VARNISHES**
  Baking and Air Drying
- **HARVEL OIL STOP**

IRVINGTON
VARNISH & INSULATOR CO., Irvington 11, N. J.

B. H. Miller, Toys
Chicago, Illinois

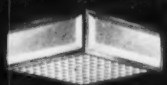


Steiner Electrical Supply Co.
Chicago, Illinois

the most significant *Lighting Development* in 20 years!

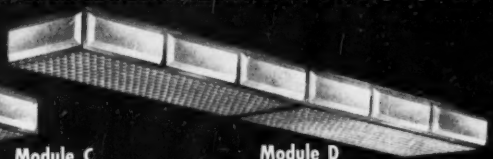
never before possible! custom-designed lighting installations at mass-production prices!

MODULE lighting is here . . . a truly revolutionary idea that heralds a dynamic new era in commercial lighting. Four low-cost "building blocks of light" easily fit together mechanically and electrically . . . end to side, end to center, end to end, or side to side. Now, you can economically fulfill specialized needs with an infinite variety of harmonious, functional lighting patterns that fit all architectural requirements. MODULE is truly superior lighting—providing an abundance of glare-free illumination with exceptionally low surface brightness. Ingeniously engineered plastic louvers and side panels provide scientifically correct shielding and eliminate unsightly dark spots. Write today for FREE 20-page MODULE booklet which fully explains and illustrates the unlimited possibilities of this modern lighting miracle.

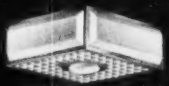


Module A
Four 14-watt T-12
15" type F lamps

Module C
Four 40-watt T-12
48" type F lamps



Module D
Four 75-watt T-12 425
milliamp Slimline lamps



Module B
One 32-watt 12" Circline
lamp, and one Par Spot
or Floodlamp

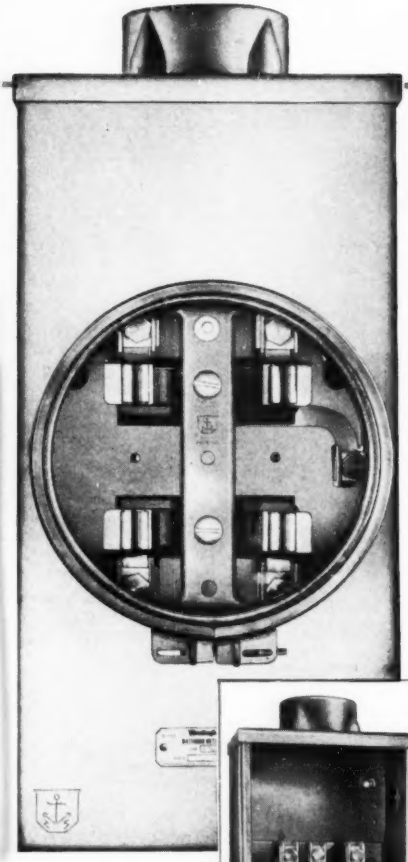
MITCHELL
module
REG. U. S. PAT. OFFICE

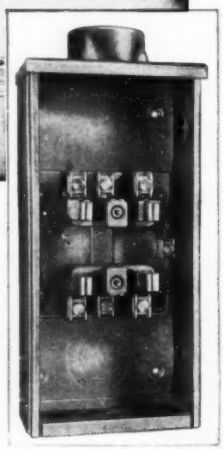
MITCHELL MANUFACTURING CO.
2525 Clybourn Avenue, Chicago 14, Illinois
Please send full details on MITCHELL MODULE

Firm Name_____
Address_____
City_____ Zone_____ State_____
Attention:_____

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





Interior view of Type STU four-jaw socket with 2½" hub for use with single-phase, 50-ampere socket meter.

Also available: Type STU five-jaw socket with 2½" hub for use with 2-phase, 3-wire grounded neutral socket network meter. (Type-CS-5.)

NEW

175 AMP. METER SOCKET

Cuts Costs!

NOW you can eliminate the expense of special meter boxes by using the new Type STU meter socket for heavy current loads. Westinghouse has designed a self-contained socket that can take standard S-type meters. Installation costs are cut 'way down. Here are the reasons why:

A Socket takes up to No. 0000 cable . . . eliminating overheating. In fact, the large-size cable actually draws heat *away* from meter.

B Removable jaws and terminals in this new Westinghouse socket allow meter box to be mounted at convenience of contractor, prior to connecting up service wires.

C 175-amp socket uses standard parts and standard meters—allows the use of the right-sized conductor for the load requirements of the consumer.

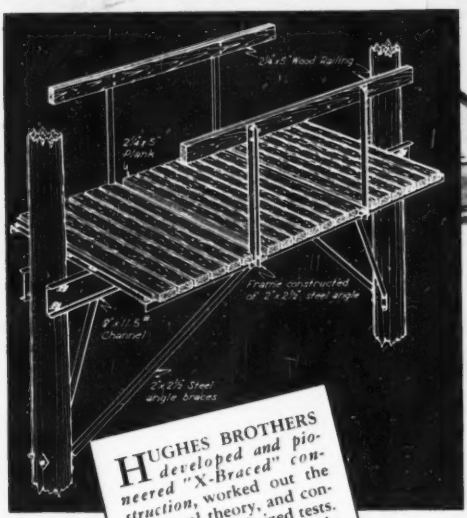
Contractors will find this Westinghouse meter socket is just right for athletic fields, outdoor pumping installations, for electrically heated homes, for many other large load requirements. For more details on this moneysaving socket, ask for supplement to catalog 42-110, effective January 20, 1950. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-40375

Westinghouse
WATTHOUR METERS

ECONOMICAL TO INSTALL

Hughes STANDARD TRANSFORMER PLATFORMS

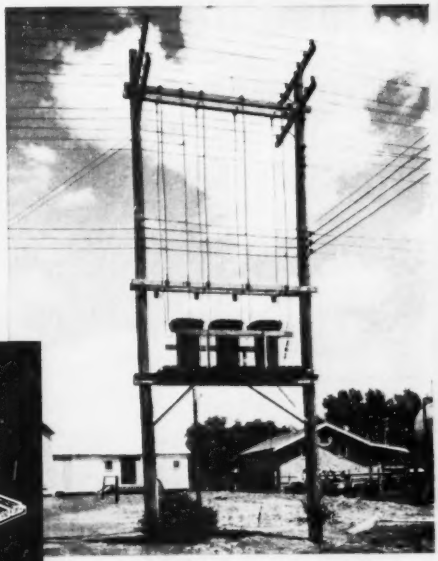
(Another Hughes development for better Transmission and Distribution Structures)



HUGHES BROTHERS *developed and pioneered "X-Braced" construction,* worked out the structural theory, and confirmed it by full-sized tests. The results: Thoroughly reliable transmission systems, and savings of millions of dollars for the electric utility industry.

Manufacturers of

Transmission and Distribution Structures • Transmission Line Hardware • Prefabricated Wood Substations • Transformer Platforms • Wood Bayonets • Special Wood and Steel Items.



← Open Type Transformer Platforms are available for stock shipment in three standard sizes for center-to-center pole spacing.

Standard — No. 1034 — 12 ft.
1070 — 15 ft.
1036 — 16 ft.

All units are made so poles may vary 6" in spacing.

Complete units can be relocated, if necessary, to meet changing service demands.

Hughes Standard Transformer Platforms are complete, prefabricated units, ready and easy to install. They're economical because they are carefully fitted at the factory and shipped with all bolts — ready to install. There is no cutting, fitting, nor costly delay in assembly on the job. They have a generous safety factor. Wood parts are of heavy Washington Fir — hot oil treated with pentachlorophenol. Steel parts are hot dip galvanized. Also made in the alley type, bridge type, light load type, spread channel type, and for lighting transformers, and any practical pole spacing. For complete information drop us a note.

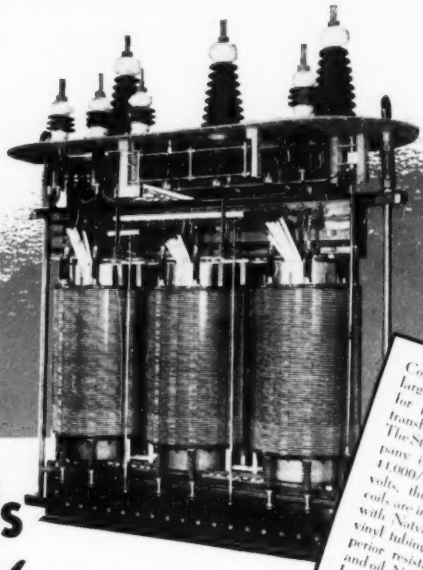
Standard platforms are "unit packaged" all parts except channels are in one shipping box — no misplaced parts or extra trips to storeroom.

WHEN IT'S HUGHES . . . *It's Tailored* TO YOUR NEEDS

HUGHES BROTHERS
SEWARD — NEBRASKA
FOUNDED - 1821 — INCORPORATED

"HUGHES" TRANSMISSION & DISTRIBUTION MATERIAL MEN — WOOD — METAL

The Standard Transformer Company Insulates and Protects Transformer Leads and Coils *with* NATVAR 400

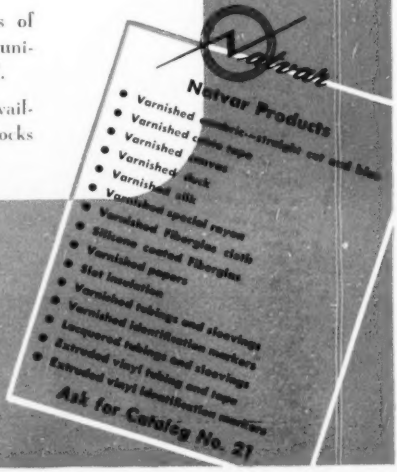


Core and coil assembly of a large power transformer ready for placing in its tank. This transformer, manufactured by The Standard Transformer Company is rated at 5000 KVA, 11,000/66,000 to 5775/10,000 volts, three phase. Leads and coils are insulated and protected with Natvar 400, the extruded vinyl tubing and tape with superior resistance to both heat and oil. Natvar Varnished Cambric and Natvar Cable Tape are also used in Standard transformers.

The Standard Transformer Company, Warren, Ohio, uses only high grade insulating materials in the transformers they build because they know how much these materials contribute to their performance —their long life, dependability, and surge proof qualities.

Natvar 400, approved for continuous operating temperatures of 105° C., gives lasting insulation and protection because of its uniformly superior resistance both to high temperatures and to oil.

Natvar 400 and other Natvar flexible electrical insulations are available for immediate delivery, either from your wholesaler's stocks or from our own.



THE NATIONAL VARNISHED PRODUCTS Corporation

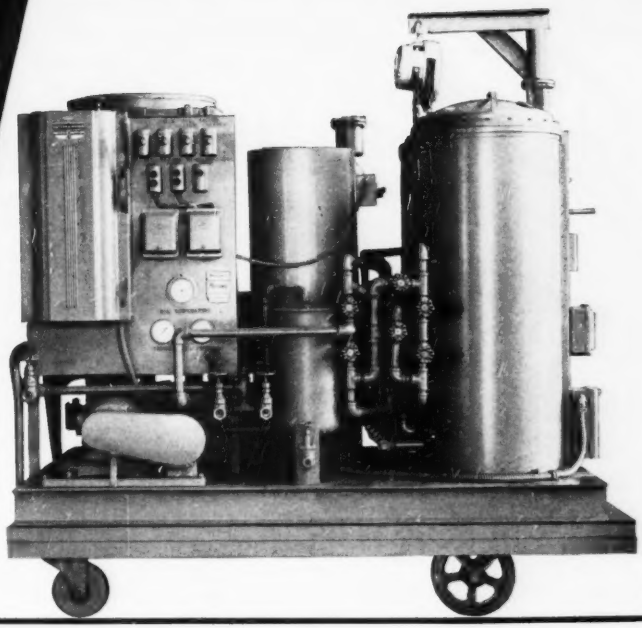
TELEPHONE RAHWAY 7-2171 — CABLE ADDRESS: NATVAR, RAHWAY, N. J.

221 RANDOLPH AVENUE ★ WOODBRIDGE, NEW JERSEY

Here it is at last... in One Package!

a COMPLETE SYSTEM for PURIFYING INSULATING OIL

. . . in the Field or at Central Station



Houdaille* Purivac

Here in one compact unit is a complete purification, dehydrating and degassifying system for insulating oils. The Houdaille PURIVAC can be connected directly to transformer and operated while the transformer is in service or out of service.

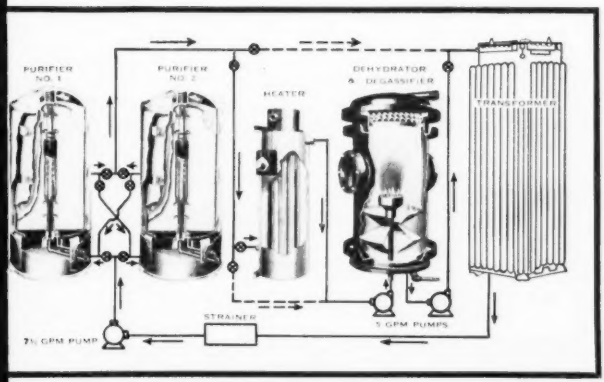
PURIVAC can be set up either in the field or at a central station for equally efficient oil reconditioning performance; serves either above-ground or subway-type transformers.

PURIVAC's dual purifiers can be operated separately, in series or in parallel.

PURIVAC's automatic electric vacuum unit atomizes oil and performs complete dehydration and degassification without need for high surface-temperature heaters or blotter press equipment. Automatic temperature control assures even distribution of heat, efficient system operation.

PURIVAC is engineered to meet the most *exacting* Utility requirements . . . compactly designed and built to serve *all* requirements.

Write or phone now for complete details . . . or, at your request, a Honan-Crane Sales Engineer will call for consultation on your problems.



Flow diagram showing progress of transformer insulating oil through purifying, dehydrating and degassifying units of the new Houdaille PURIVAC. Complete reconditioning of the oil is accomplished by this one compact system.

*Pronounced Hoo-Dye

CLEAN OIL ENGINEERING

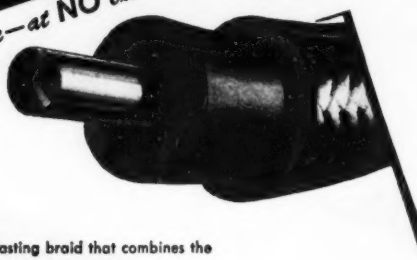
A SUBSIDIARY OF
HOUDAILLE-HERSHEY CORP.

HONAN-CRANE CORPORATION, 819 Wabash Ave., Lebanon, Ind.

At last
BUILDING WIRE THAT LASTS LONGER, PULLS EASIER, SAVES MONEY

...Thanks to
TRIANGLE'S
new braid of
GLAZON

For EXTRA value—at NO extra cost—Insist on "GLAZON"



What "GLAZON" is:

"Glazon" is a tougher, more flexible, longer-lasting braid that combines the desirable properties of an inorganic substance derived from glass with those of special saturants to achieve a new high in safety and durability under the most adverse conditions. This new protective covering gives:

LONGER LIFE. Conductors and insulation are doubly protected by a stronger, tougher, more impervious and more durable covering than heretofore possible.

SMALLER DIAMETER. Braid, although stronger, is considerably thinner. Strands lie flatter, clasp insulation tighter, absorb less saturant—reducing diameter.

GREATER FLEXIBILITY. Less bulk and greater elasticity of the braid increase flexibility.

SMOOTHER SURFACE. Uniformity of fiber and tighter lays eliminate the uneven surface common to many braided coverings.

GREATER RESISTANCE to the destructive elements of man and nature: water, heat, oil, acid, corrosive fumes, fungus, rodents, sunlight, freezing, rotting.

IMPROVED FISHABILITY. "Glazon" covered wire can be snaked through longer conduits, around sharper bends, easier, quicker, than any other type.

EVEN SURFACE, free from bumps and ridges, slides easier.
SMALLER DIAMETER saves space, makes it twice as easy to snake in "that last one."
SMOOTH FINISH prevents sticking, reduces friction on long runs and around sharp bends.
TOUGH COVERING resists impact and abrasion.
GREATER FLEXIBILITY saves time in wiring every junction box, switch box, outlet box.

Costs No More—Yet Saves At Every Step of the Wiring Job

Available in sizes from No. 14 through No. 6 AWG with solid or stranded conductor.
Types R, RH, RW.

If It's "GLAZON" It's Made by TRIANGLE . . .
If It's Made by TRIANGLE It MUST Be Right!

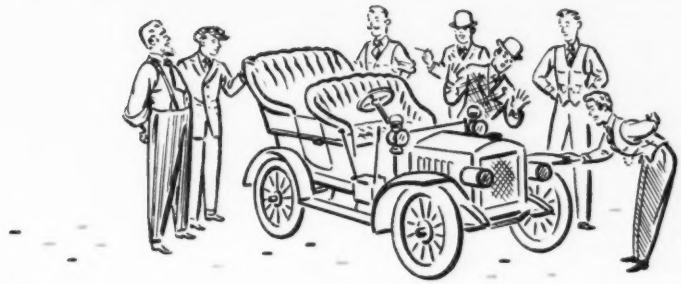
For full information, contact your nearest Triangle distributor or representative, or write

ARTERIES FOR ELECTRICAL SYSTEMS
INCORPORATED
IT MUST BE RIGHT!

TRIANGLE CONDUIT & CABLE CO., INC.
1900 Jersey Avenue, New Brunswick, N. J.

BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED TRIOPRENE TRENCH, POWER AND PARKWAY CABLES
RIGID CONDUIT • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

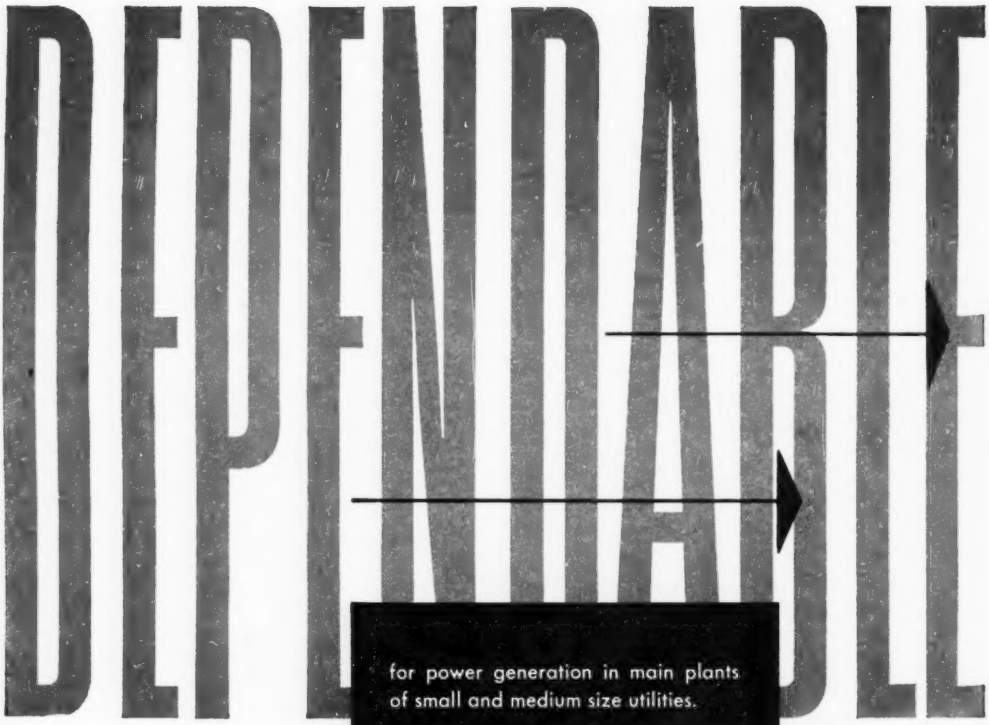
HOW OLD is New Fangled?



IT'S eighteen years now since Lapp Line Posts were introduced. "New-fangled!" objected the same type of cautious soul who a few years earlier was telling everyone that radio broadcasting was all right for a fad but it would never replace the ouija board. Admittedly revolutionary in design and construction, Lapp Line Posts received a "baptism under fire" . . . on trouble-spots that had proved too much for all other insulators. Their performance in those earliest tests . . . and their performance over the past eighteen years . . . has won them the most enviable record of any insulator in use today. On the hundreds of installations now using Lapp Line Posts on which records of performance are kept, *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator.* For maximum performance, maximum economy, you can't afford *not* to standardize on Lapp Line Posts.

PERFORMANCE IS PROOF

Lapp INSULATORS



for power generation in main plants of small and medium size utilities.

for voltage booster stations at the end of long transmission lines—to act as two-way power feed when line trouble is encountered in storms, overloads, and other circumstances.

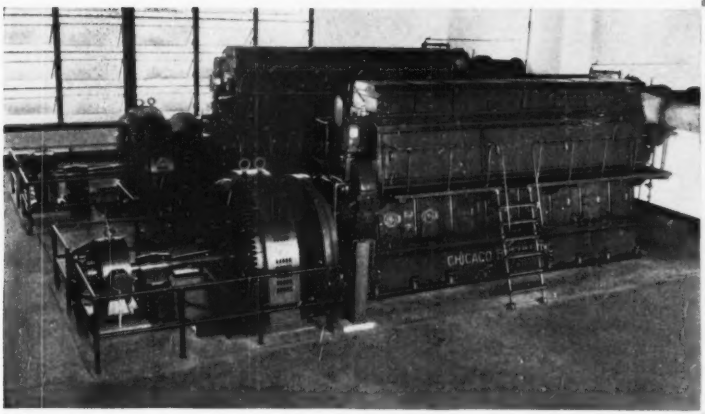
for semi-portable or portable units for emergency hook-ups during transmission line repairs and replacements.

for installation in communities where a local generating plant may be an important element in franchise negotiations.

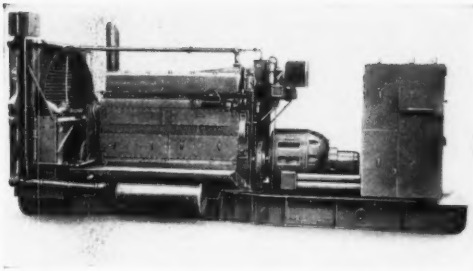
for power units in central station plants of large utilities.

For these various purposes Chicago Pneumatic provides a complete line of Diesel and Dual Fuel Units ranging from 100 to 1200 KW. Write for full information.

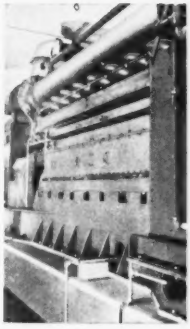
CP diesel and dual fuel engines

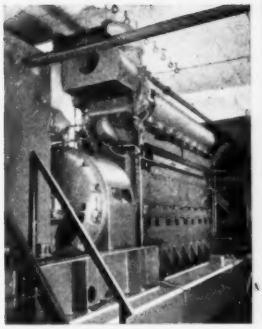


A key generating plant of prominent midwest utility.



Package unit as used in temporary installations during transmission line repairs and replacements.



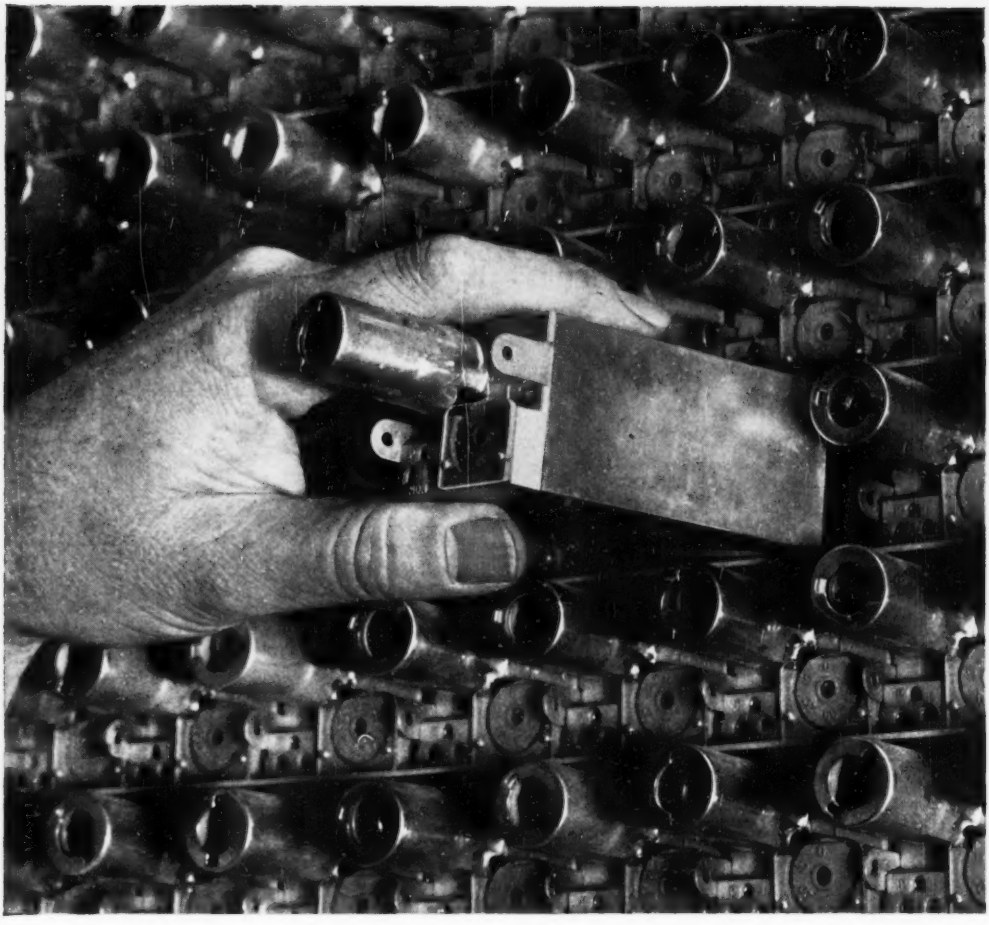


Typical small community installation on end of a transmission line, providing voltage regulation and two-way power feed.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



ANOTHER SCORE IN THE

battle of the inches

It takes many costly buildings to house your telephone system. Every inch saved helps keep down the cost of telephone service. So at Bell Telephone Laboratories engineers work constantly to squeeze the *size* out of telephone equipment.

In the picture a new voice frequency amplifier is being slipped into position. Featuring a Western Electric miniature vacuum tube, tiny permalloy transformers, and special assembly techniques, it is scarcely larger than a single vacuum tube used to be. Yet it is able to boost a voice by 35 decibels. Mounted in a bay only two feet wide and 11½ feet high, 600 of the new amplifiers do work which once required a *room* full of equipment.

This kind of size reduction throughout the System means that more parts can be housed in a given space. Telephone buildings and other installations keep on giving more service for their size – and keep down costs.

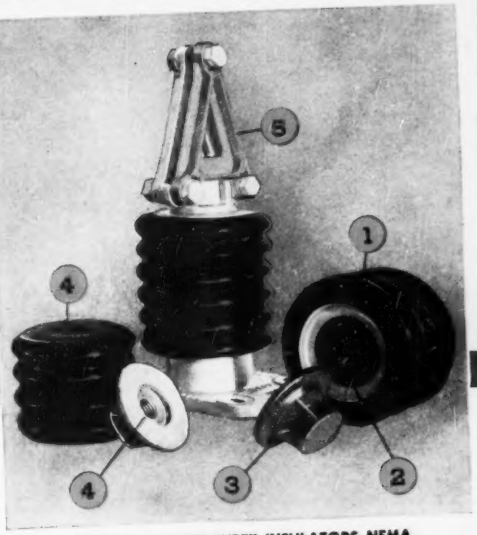
The new amplifiers, which will soon be used by the thousands throughout the Bell System to keep telephone voices up to strength, are but one example of this important phase of Laboratories' work.

BELL TELEPHONE LABORATORIES EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

A RECOGNIZED STANDARD SINCE 1912

TODAY STRONGER MECHANICALLY BUT STILL INTERCHANGEABLE WITH OLDER UNITS

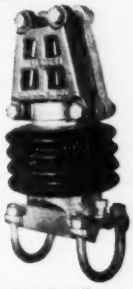
Delta-Star "Unit Type" indoor bus supports, also known as NEMA standard construction class "A" are available in strength classes sufficient for most installations.



DELTA-STAR "UNIT TYPE" INSULATORS NEMA Construction Class "A" Single Inserts Cemented in Both Ends

1. **PORCELAIN BODIES**—are of highest grade, wet process, chocolate brown glazed, porcelain.
2. **SANDED RECESSES**—at both ends of porcelain body into which inserts are cemented.
3. **INSERTS**—are cemented in sanded recesses by Delta-Star's time tested steam room process. Accurate jigs insure uniform height, parallel surfaces top and bottom and alignment of tapped holes.
4. **360° ADJUSTMENT**—conductor and base fittings are attached to inserts by a single bolt at axis of porcelain permitting full 360° rotational adjustment.
5. **FITTINGS**—every type of conductor and base fitting available—easy to install and convenient for storeroom stock.

7.5-kv Heavy Duty Type "VBH"



7.5-kv Extra Heavy Duty Type "WUB"

7.5-kv Standard Duty Type "RP"

7.5-kv Standard Duty Type "HL"

50,000 BUS SUPPORT COMBINATIONS

Flexible design of indoor UNIT TYPE bus supports has real advantages, permits field assembly in many combinations. All parts interchange, can be carried in stock, have high salvage value should changes necessitate removal to another location.

Bulletin 31-C lists parts to make 50,000 combinations—clamp fittings for any conductor, base fittings for any mounting, insulator strength classes 2, 3 and 4 in voltage ratings of 7.5, 15 and 23-kv.

DELTA-STAR ELECTRIC COMPANY

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NEW YORK OFFICE—140 Cedar St., New York 6, N. Y.

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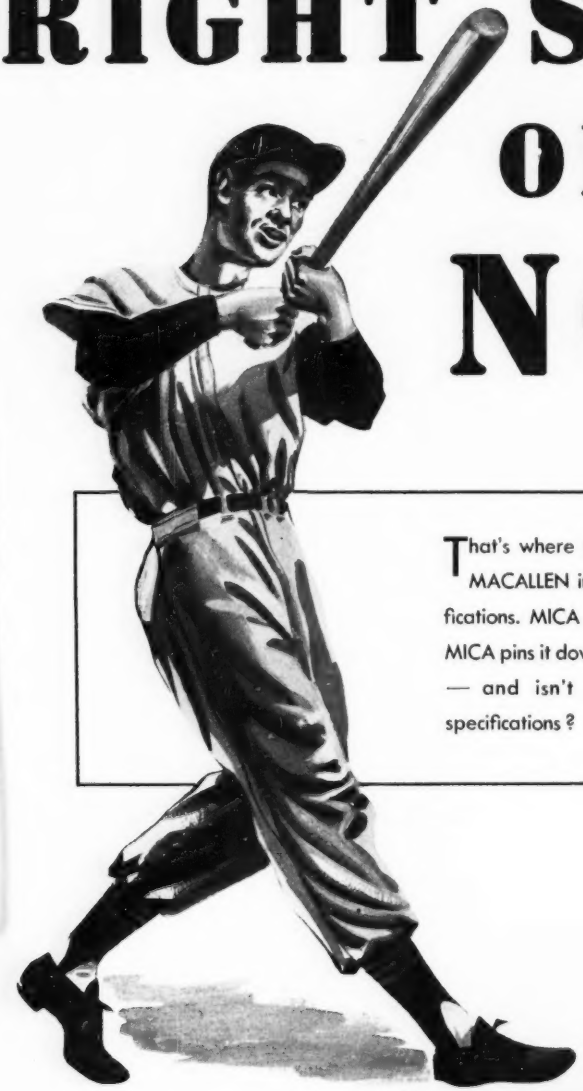
CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada

RIGHT SMACK ON THE NOSE!



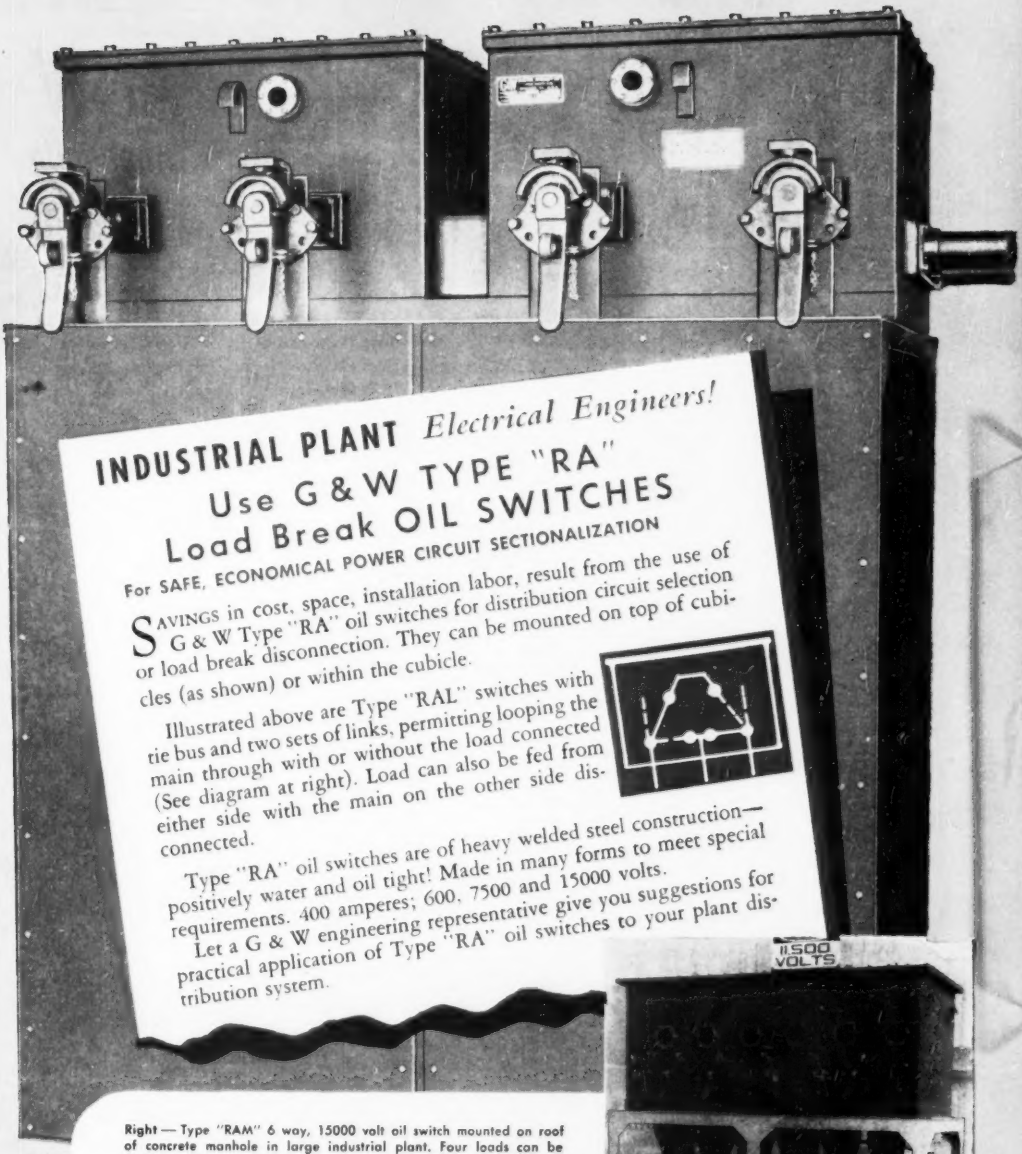
That's where you hit 'em when you write MACALLEN in front of MICA in your specifications. MICA is fine, but only MACALLEN MICA pins it down to something really specific — and isn't that why they call them specifications?

when you think of MICA, think of MACALLEN

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

THE MACALLEN COMPANY 16 MACALLEN STREET • BOSTON 27, MASS.
CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.



INDUSTRIAL PLANT *Electrical Engineers!*

Use G & W TYPE "RA" Load Break OIL SWITCHES

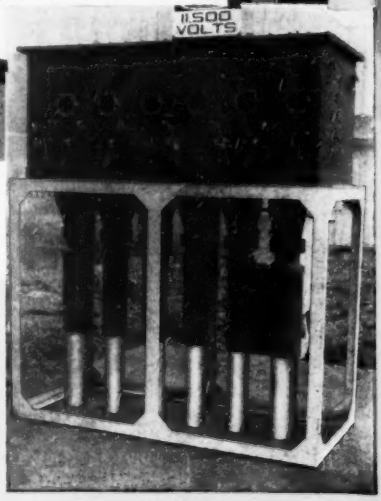
For SAFE, ECONOMICAL POWER CIRCUIT SECTIONALIZATION

SAVINGS in cost, space, installation labor, result from the use of G & W Type "RA" oil switches for distribution circuit selection or load break disconnection. They can be mounted on top of cubicles (as shown) or within the cubicle.

Illustrated above are Type "RAL" switches with tie bus and two sets of links, permitting looping the main through with or without the load connected (See diagram at right). Load can also be fed from either side with the main on the other side disconnected.

Type "RA" oil switches are of heavy welded steel construction—positively water and oil tight! Made in many forms to meet special requirements. 400 amperes; 600, 7500 and 15000 volts.

Let a G & W engineering representative give you suggestions for practical application of Type "RA" oil switches to your plant distribution system.



Right — Type "RAM" 6 way, 15000 volt oil switch mounted on roof of concrete manhole in large industrial plant. Four loads can be isolated independently and loop circuit sectionalized by operating external levers.

WRITE TODAY FOR YOUR COPY OF BULLETIN H49

G&W ELECTRIC SPECIALTY CO.

7780 DANTE AVE. • CHICAGO 19, ILLINOIS, U. S. A.

In Canada — POWERLITE DEVICES, LTD., Toronto

For Uninterrupted Service Under All Network Conditions

ANW
(Anaconda Net Work)

Time-tested since 1932 under all service conditions, subsequent improvements provide additional security in this long-famous network cable.

● Tough, easily handled, Type ANW-insulated, neoprene-jacketed cable incorporates six important advantages . . . important to you for underground duct installation:

1. Better heat and flame resistance—protected by the same neoprene jacket as Anaconda mining cables which must and do meet the severe flame test of the U.S. Bureau of Mines.

2. Higher resistance to duct acids and alkalies—years of experience with Type ANW insulation with only a braid covering showed it to be highly resistant to oils, acids and alkalies encountered in soil and sewage waters. NOW it has the additional protection of the neoprene jacket which itself has shown by test and experience, excellent resistance to these agents of destruction.

3. Higher operating temperature—now 75 C copper temperature, continuous duty.

4. Superior aging—Type ANW insulation has demonstrated year after year . . . and now even better . . . long-aging characteristics under severe oxygen bomb and air bomb tests.

5. Low moisture absorption—Type ANW insulation has always had low moisture absorption . . . far less than is detrimental to safe operation.

6. More easily handled—passes 180 degree cold-bend test at 0° C without damage to jacket. Cable is lighter, easier to pull. No lead to fuse, insulation and jacket do not support combustion.

49442

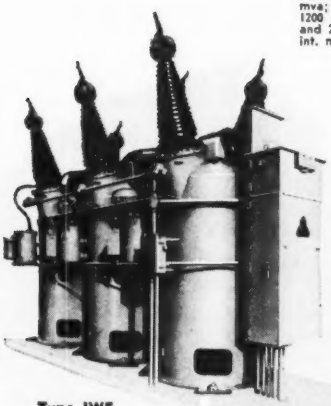
ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4, N. Y.

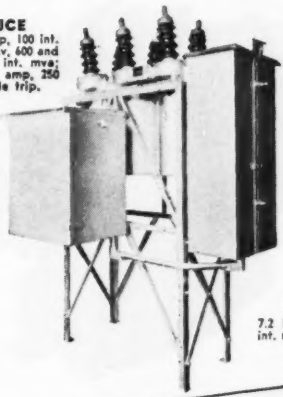
OIL CIRCUIT BREAKERS

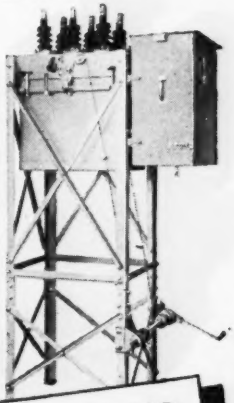
for Outdoor High-Voltage Stations . . .



Type JWE
115 kv, 600 amp, 1500 int. mva, 5-cycle trip.

Type JCE
14.4 kv, 600 amp, 100 int. mva; also 14.4 kv, 600 and 1200 amp, 250 int. mva; and 23 kv, 600 amp, 250 int. mva, 8-cycle trip.





Type AKE
7.2 kv, 600 amp, 50 int. mva, 8-cycle trip.

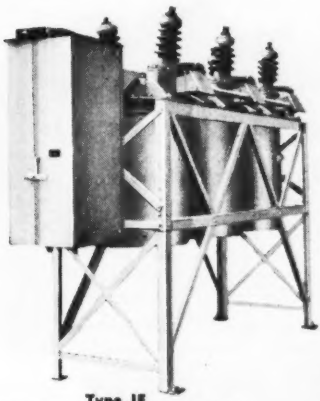
Reliability and Low Maintenance

All Pacific breakers, large and small, embody the **same** time-tested design elements:

(1) **Motor-Compressed-Spring Stored-Energy Operating Mechanisms** assure identical opening and closing times, regardless of frequency of operation.

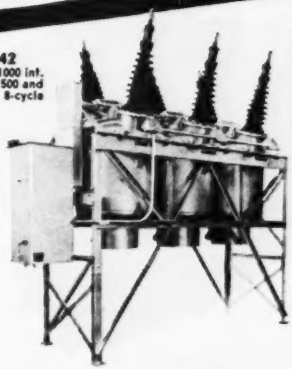
(2) **Arc-Expulsion Chambers** with directed gas blast extinguish arcs without appreciable rise of tank pressure or burning of contacts.

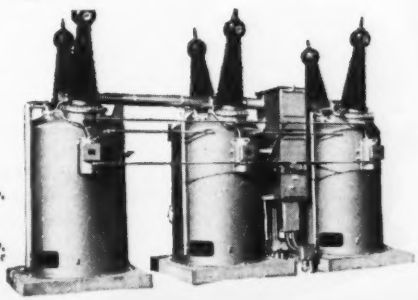
(3) **Sliding Shoe Contacts** with **Leaf-Type Pressure Springs** eliminate stress on bushings, require no sensitive adjustment to maintain pressure or fix closed position. Wiping action reduces pitting. Restrikes reduced because contacts separate only when traveling at high speed.



Type JE
23 kv, 1200 amp; 34.5 kv, 600 amp, both 500 int. mva; and 34.5 kv, 1200 amp, 1000 int. mva; also 46 kv, 600 amp, 500 int. mva, and 1200 amp, 1500 int. mva, 8-cycle trip.

Type JE-42
69 kv, 600 amp, 1000 int. mva; 1200 amp, 1500 and 2500 int. mva, 8-cycle trip.





Type RWE
115 kv, 138 kv, and 161 kv, 1200 amp, 3500 int. mva, 5-cycle trip.

Type RHE
Is similar, for 138 to 230 kv, 800 amp, 5000 int. mva; or 1200 amp, 7500 or 10,000 int. mva, 3-cycle trip.

AIEE and NEMA Standards

Get All Facts . .

Call

PACIFIC ELECTRIC MFG. CORPORATION

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ARKANSAS ELECTRIC CO., 316 Louisiana St., Little Rock, Ark.
WILLIAMSON & WILMER INC., 617 Mutual Bldg., Richmond 19, Va.
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WITH ALL THEIR EXTRA VALUE...

DODGE

"Job-Rated" TRUCKS are priced with the lowest!

It's what you get for what you pay that counts!

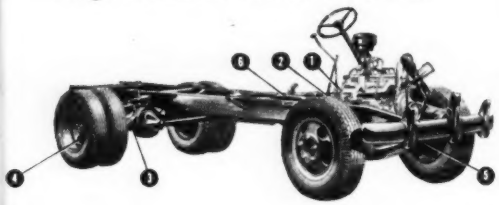
Read, on this page, why Dodge "*Job-Rated*" trucks offer you *extra* value.

Then, see your Dodge dealer. Ask him to quote you the price of the Dodge "*Job-Rated*" truck that fits your hauling or delivery job.

You'll get more for your money . . . in performance, in economy, in long-lasting truck satisfaction.

See your Dodge dealer *now*.

Dodge "Job-Rated" Chassis Features



1. SUPER-FRICTION CLUTCHES. Large frictional areas. "*Job-Rated*" for smooth action and long life.

2. RUGGED 3-, 4- or 5-SPEED SYNCHRO-SHIFT TRANSMISSIONS —"*Job-Rated*" for the load. Carburized gears; heat-treated shafts; antifriction bearings throughout.

3. FULL-FLOATING REAR AXLES . . . Hypoid design; banjo-type housing . . . "*Job-Rated*" for the load. Long life . . . low upkeep cost.

4. CYCLEBONDED BRAKE LININGS (no rivets) prolong brake life.

5. CROSS-TYPE STEERING . . . Sharp turning angle; easier handling, and parking.

6. SAFETY-LOCATED GAS TANKS . . . Outside the cab, NOT inside!

• • •

NEW STEERING COLUMN GEARSHIFT . . . Standard equipment on ½-, ¾- and 1-ton models with 3-speed transmissions . . . provides easier handling, more unobstructed floor space, greater safety of operation.

"RIGHT-SPOT" HAND BRAKE . . . under the center of the cowl . . . right where you want it. Standard on all ½-, ¾- and 1-ton models. Provides unobstructed floor space; easier passage through either cab door.

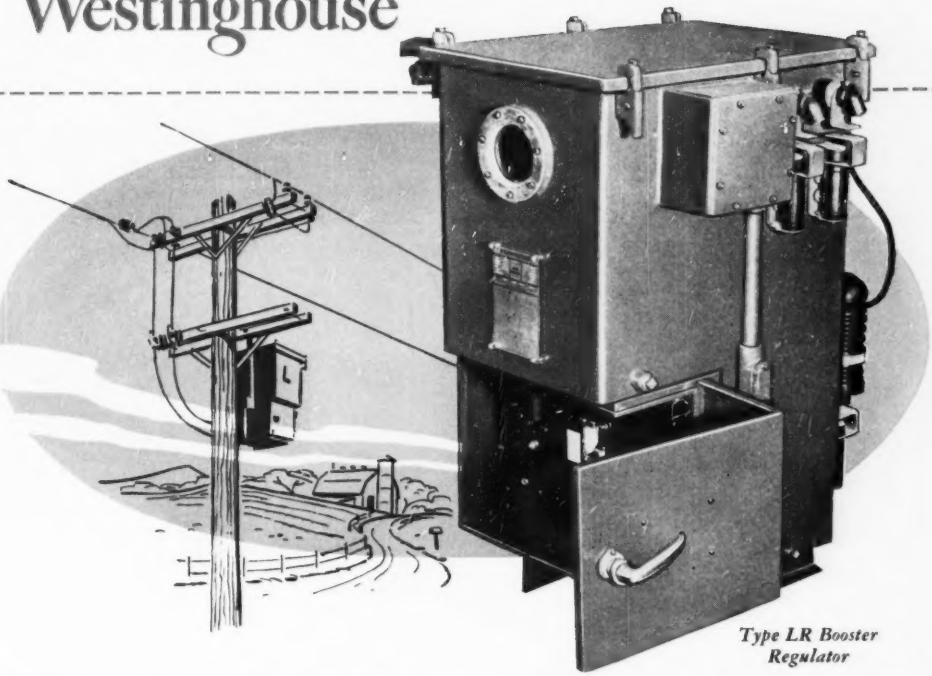
Dodge "Job-Rated" Engine Features!

- **FAMOUS DODGE L-HEAD TRUCK ENGINES . . .** "Job-Rated" for your loads; save gas, oil.
- **COMPLETELY SPLASH- AND DUST-PROOF ELECTRICAL SYSTEM . . .** with high-output generator. Resistor-type spark plugs, and high-output coil, insure amazingly smooth engine operation; longer plug life.
- **EXHAUST VALVE SEAT INSERTS . . .** resist wear and pitting. Reduce valve grinding; preserve performance.
- **REPLACEABLE PREFITTED MAIN BEARINGS . . .** precision, long-life quality. Reduce maintenance costs.
- **FULL-PRESSURE LUBRICATION . . .** positive pressure to main, connecting rod and camshaft bearings and camshaft drive, prolongs engine life.
- **FULL-LENGTH CYLINDER COOLING . . . 4-RING ALUMINUM ALLOY PISTONS . . . OIL-BATH AIR CLEANER** and many other money-saving features!

For the good of your business...
switch to DODGE "Job-Rated" TRUCKS

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Type LR Booster Regulator

"Booster Regulators Eliminated 500 Customer Complaints Annually!"

This statement from a midwestern utility superintendent is backed by his own records. They prove Westinghouse Booster Regulators pay their way with customer satisfaction.

"Greatly increased load on our rural lines created serious voltage problems. Customers complained of burned-out motors, dimmed lights and late dinners. The installation of Westinghouse Booster Regulators eliminated these complaints and *substantially increased our revenue.*"

Types LR and BR Booster Regulators are compact, pole-mounted units. They provide reliable voltage control for rural lines. *Their investment costs, as compared with other methods, are slashed as much as 95%!* Installation is quick and easy. Maintenance is negligible.

For complete information about *every* voltage regulation need, call your nearest Westinghouse office, or write for C. S. 47-225, 47-230, B-4245 and Distribution Digest 50-000. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70530

Westinghouse Voltage Regulators

FOR ANY SYSTEM

How to stump a doctor (IN ONE ACT) •••

Doctor: Name?

Seymour: Seymour Kerite.

Doctor: Age?

Seymour: 95.

Doctor: Er, would you repeat that, please. For a second I thought you said 95, ha-ha.

Seymour: I did.

Doctor: Good gracious, you must be about ready to cash in your chips! Here, lie down while I take your blood pressure. Hmmmm. Ahem. Ahhh, yes. Remarkable!

Seymour: The verdict, doc?

Doctor: Unbelievable! Why, you're in perfect condition. Lively, healthy, and vigorous. How in the world do you do it?

Seymour: You see, doc, it's like this. For nearly a century I've been busy keeping folks satisfied — supplying them with cable insulation that stands up no matter what, lasts a long, long time at a low, low cost per year. And in spite of the fact that many new kinds of insulation are available today, more people want Kerite than ever before — keeping me busier and busier. I *have* to stay young, doc, to keep these folks happy.

Doctor: Very unusual, yes, very. Old in experience, young in spirit. Hmmmm, interesting case.

Seymour: Your prognosis, doc?

Doctor: Mr. Kerite, this examination leads me to believe that you will stay young as long as the electrical industry needs cable insulation with long life and low cost per year.

Seymour: Those are my plans, doc!

The Kerite Company, 30 Church St., New York 7, N. Y.

Kerite Insulation—
Your Cable's Best Life Insurance

KERITE CABLE

Employee Stock Purchase Plans

EMPLOYEES are anxious to be stockholders of the company for which they work. Such an opinion is amply substantiated by the results of employee purchase plans of Pacific G&E, Philadelphia Electric, Central Ohio L&P, and Pennsylvania P&L. Other conclusions that can be drawn from these cases include the following:

Employees like the opportunity to purchase at the discounted offering price.
There is a substantially greater demand for stock than has been met by these recent sales to employees.
A substantial number of employees can and will pay cash.
Stock purchase plans get a warm reception.

Why do not more companies provide this opportunity to their employees, one might ask, if such satisfactory results are obtained?

The answer is, of course, obvious to those in the policy making group who worry about the fluctuating price of stock. It is obvious to those with vivid memories of the 1920's. In fact, talk to those employees who purchased common stock of their employer just before the crash, and it is easy to say, "Never again!" The pre-emptive right of present stockholders also presents a ready excuse.

If several of the utilities had not blazed the trail, one might give up hope in crusading for employee stock purchase plans. But even more important than these successful plans is their relationship to the fight against socialism. More free-enterprisers in the form of employee-stockholders is another way of teaching the economic facts of life. Now is the time to give employees an opportunity to share in the industry on the same basis as stockholders.

The plans used by the various companies are quite similar and are apparently satisfactory in most respects. Employees are allowed to apply for stock not subscribed by stockholders under their pre-emptive rights. The company retains the prerogative to allocate stock proportionately when employees subscribe for more than that left over. Provisions for payment over a 12 month period are also included. There have been no reports of complications in this procedure.

The Kansas-Nebraska Natural Gas Co has gone a step farther. Here, stockholders voluntarily waived enough of their rights to give employees a reasonable opportunity to buy. Such an idea can be carried out in every company by circulating the shareholders with appropriate blank forms to give proper authority for a waiver in behalf of employers of a percent of their rights. Obviously this waiver would not be exercised if there were sufficient shares unsubscribed to fill the employee requirements.

The methods of allowing employee participation in new issues are amply tested. The willingness on the part of management to take action is the only hurdle remaining. Will other leaders use this method of promoting voluntary investment of funds? It is one way of preventing involuntary investment via taxation in a socialized industry ten years from today.

The Trend in Fluorescent Lighting

IT WAS a comfortable time, before 1938, when the incandescent lamp was the only artificial light source in general use. There was no bother about color temperatures, brightness ratios, and all the other esoteric factors that now complicate the lighting scene. There was just a point source of light whose emanations were easily controlled and which, by its limitations, restricted the art of illumination to very simple terms. And everyone was happy because no one knew differently.

Then came the fluorescent lamp to change the whole picture. With fluorescent it was possible to reproduce daylight exactly, or nearly enough to make no matter. But, surprisingly, all people did not want daylight reproduced. Well, what did they want? Warm white light, which is of a pinkish cast? Or a yellow tinge? Or 3,500 or 4,500 or 6,500 degrees Kelvin, which means nothing at all to the uninformed?

What will public acceptance finally settle on? The long tube or the short one, the thin one or the fat one, bi-pin or single-pin? Who cares? Not the public. All it cares about is satisfactory lighting. But the makers and sellers of lamps and associated equipment care. So do the electric utilities whose customers must have satisfactory lighting.

The public does not, and never will, determine the trend in fluorescent lighting. It is mere idle exercise in statistics to attempt to define such trend in terms of public demand for this, that, or the other kind of tube or equipment. The demand is simply a measure of acceptance of what is available. Its indications are not definitions of trend in fluorescent lighting. The trend is latent in the research laboratories and in the minds of inventive men and is not usually revealed in advance. However, if one insists on having something to call a trend, it is to be found in the earnest efforts of manufacturers to increase their markets by offering improved light sources and equipment for public acceptance. Lamps of longer life and more pleasing color characteristics, more effectively employed in improved fixtures and installations are the elements of the trend. It is towards more light and better light.

Now Is The Time

JUST EMERGING from a capacity shortage, the electric utility industry is faced with another kind of shortage. It is a shortage of creative selling. A capacity shortage can be made up, then is over and done with. But a selling shortage can never be made up. It is a permanent loss that never can be regained because it is impossible to sell enough today to make up for what was not sold yesterday. In terms of selling, yesterday is gone forever, and today cannot compensate for it in any degree. Today's selling is always today's, can never be yesterday's.

It is common knowledge in the industry that electric utility sales activity, measured on any yardstick—top executive interest, number of personnel, intensity of effort, or what have you—is now below what it was pre-war. Considering population increase and modern developments in electricity utilization, it is far, far below what it should be for the maintenance and expansion of market necessary to maximum future growth and prosperity. One might say, judging from present conditions, that the electric utilities, with a few outstanding exceptions, are prepared to be content with minimum future growth and prosperity.

Evidences of this condition are plentiful. Ask almost any power company sales head for his testimony. The latest in this line was brought forward by Ebasco's W. L. Byrne at the sales meeting of the Southeastern Electric Exchange last week. He said that a survey of 14 companies showed 40% more customers in the commercial service class than before the war and 10% fewer salesmen to build load among them. A survey of 14 companies does not represent the whole industry, but, in the circumstances of the present case, it can certainly be taken as strongly indicative of the general condition.

Byrne said now is the time to get going on selling. Yesterday was the time, too, and so was the day before. But those days are lost and "now" cannot be any sooner than today. To put off the "now" until tomorrow is to approach closer to the desperate urgency of "Now or never!" which will be followed by a regretful "Too late!" if procrastination continues. We do not believe this unhappy sequence will develop to its deplorable end. The history of the industry contradicts any such thought. But it is perfectly plain that each additional day of neglect of selling brings closer the time of "Now or never." And remember the old cliche from the sun dial, "It is later than you think."

Tell Them What It Costs

WHEN FALSE statements about the cost of power in New England began circulating, the New England Council offered $100 to anyone who could prove that an industry left New England because of electric rates. Of course there were no takers.

Eastern North Carolina has now been accused by Governor Scott of retarding industrial development because of higher rates than those in Western Carolina. This is an easy conclusion to reach when no facts are required. But if proof were asked for, it would be the same as in New England. The retarding factor may be labor, climate, or raw materials, but the accusers just say power. When the newspaper reiterates the story without proof, a few more innocents may be influenced.

The power companies have another public relations job to handle in a swift, efficient manner. It might be possible for the Western Carolina utilities to join those from the East in clearing up this misconception.

The Electrical Week

Come the December peak and the utilities will not need to worry. Edison Electric Institute's semi-annual survey indicates a margin of over 11.5% . . . Despite the coal and steel strikes, energy output is staying remarkably high, down only 2.2% from last year for the week ended Oct 29. The obvious explanation is the terrifically high sales to residential, rural, and commercial customers. For August, latest figures available, residential sales were up 15.6%, rural 19.3%, and commercial 8.2%.

New Federal Power Commissioner Mon C. Wallgren has the job but not the office of Leland S. Olds. Office which Olds occupied in Washington for ten years will become a Commission conference room, and a new suite is being prepared for Wallgren.

ELECTRICAL WORLD, like many others, is feeling the effects of the coal strike. The railroads serving Albany where EW is printed are curtailing service. The result may be a delay in the delivery of the magazine.

George W. Haggard, assistant administrator of Rural Electrification Administration since last Jan 1, has been appointed deputy administrator. He succeeds in REA's No. 2 post William J. Neal, who died Oct 26 in an auto crash (p 122).

Dayton Power & Light Co lost its entire 330,000-kw system at 9:17 am, Nov 1. Some 280 communities in 24 Ohio Counties were without power for about 90 minutes. The cause is not yet known. Supposition is that both units at new O. H. Hutchings station went out and this in turn threw out the Tait station.

It Ain't Hay—Northern Virginia Power Co has received a claim for $70 from a farmer. The agriculturist claims his horse died after eating blueprints left behind by a construction crew.

Notes from the CIO convention—The Utility Workers Union reported winning 18 bargaining elections and 106 union shop polls in utility plants since last November . . . UEW reported its unemployed rolls have risen from 42,000 to 105,000 over the past year . . . Three states were reported to have changed their laws regulating public utility labor disputes: (1) New Jersey set up standards to guide arbitrators in their decisions. (2) Michigan substituted voluntary for compulsory arbitration. (3) Wisconsin broadened its law to include co-ops.

By 1951 Hartford Electric Light Co's postwar program will have reached a total of $2.5 millions for substations alone.

"Let's Meet the Challenge," the theme of this year's meetings of the Pennsylvania Electric Association, was suggested by an editorial, "Objectives," in the June 8, 1946, issue of ELECTRICAL WORLD.

Genoa, oldest city in Nevada, has a sweet way of financing street lighting. Annually it holds a candy dance, an all-night party in the community hall, to raise street-lighting funds for the coming year.

Boston Edison's enlarged Edgar Station in North Weymouth, Mass., now represents a capital investment per plant employee of $200,000. Station rating is 251,110 kw.

White House says President Truman has no plans for attending the power-for-New England Democratic Regional Conference in Boston, Nov 20-21.

Utilities might sell twice as much common stock as has been issued so far this year if they would only explain to the small investor how and where to buy the stock.

The Hawaiian Electric Co, Honolulu, will divorce its retail appliance sales from its public utility operations next Jan. 1.

Notes From The News

P. A. Norris, chief operating engineer for Virginia Electric & Power Co, has declined an award of $520 made by the Virginia Industrial Commission. Norris, who injured his leg while at work, said that the company had paid him his full salary while he was incapacitated . . . Linemen of the Memphis Municipal System are striking for higher pay . . . A laboratory for advanced work in studying alternating currents has been opened by the Catholic University at Washington, D. C.

Adequate Reserve Now Within Reach

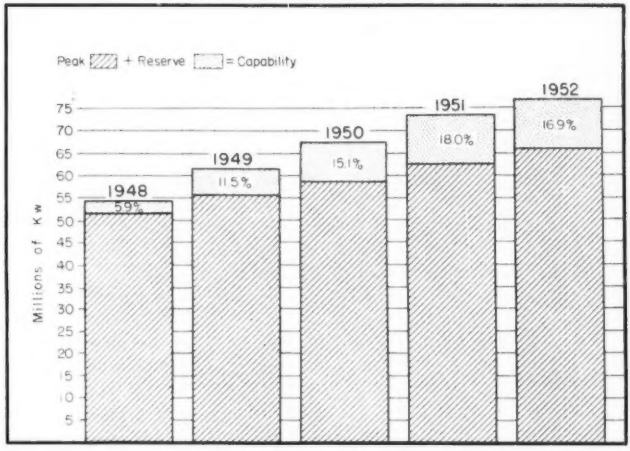
Total National Generating Capacity Expected to Exceed Demand by 11.5% at 1949 Peak; Margin to Pass the 15% "Adequate" Mark by End of 1950

ADEQUATE RESERVE of electric generating capacity, the elusive will-o-the-wisp pursued by the electric utility industry through years of war and equipment shortages, finally is within reach.

The coming 1949 peak will find the industry enjoying an 11.5% bulge in total national capacity over demand, as compared with narrow margins of 5.4% and 5.9% experienced in 1947 and 1948, respectively. And the industry will attain a national margin of a little over the 15% it considers as "adequate" by the end of 1950. The margin will rise to 18% in 1951 and will amount to at least 16.9% in 1952.

These estimates resulted from the latest semi-annual power survey of the Edison Electric Institute, announced this week by EEI President Elmer L. Lindseth. The report, covering estimates of generating capacity, peak loads, and construction plans for both public and privately owned utilities, was prepared by a committee headed by Walker L. Cisler, Detroit Edison Co. Other members of the survey group were C. W. Mayott, Hartford Electric Light Co; N. B. Hinson, Southern California Edison Co; V. M. Marquis, American Gas & Electric Co, and J. E. Moore, Ebasco Services.

Industry experts feel that a margin of better than the predicted 11.5%—something closer to 14%—will be experienced during the coming December peak period. The EEI survey group based its load studies on an assumption that major strikes would end early enough to cause no serious dislocation in load growth. It had to do so in order to give a valid picture of actual demand in relation to capability.



However, the effects of the strikes already have driven energy demand below normal, and it is highly improbable that all heavy loads will return by the time of the December peak.

The jump in the national reserve margin reflects the progress of the industry's postwar expansion program, which will result in the addition of 6,929,201 kw of generating capacity in 1949. This total is substantially higher than total additions during the combined years of 1947-48, the first two years of the six-year construction program. Annual installations for the period, including a total of 23,035,226 kw of capacity to be added by the power companies and 6,809,927 kw in new governmental installations of all types, follow:

1947	2,005,386 kw
1948	4,237,831
1949	6,929,201
1950	6,173,635
1951	6,149,800
1952	4,349,300

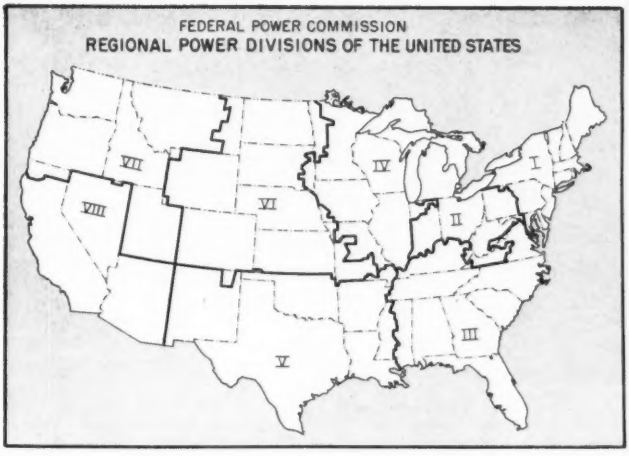
Addition of this total of 29,845,153 kw will bring the industry's total installed capacity to 80,161,774 kw, an increase of 59% above the 1946 installation of 50,316,621 kw. But even this

The Power Situation, 1948–1952, by Federal Power Commission Regions *

(All Figures in Thousands of Kw)

		1948	1949	1950	1951	1952
REGION I	Capability	14,414	15,482	16,660	17,738	18,301
	Peak Load	13,134	13,722	14,288	14,841	15,382
	Margin of Reserve	1,280	1,760	2,372	2,897	2,919
REGION II	Capability	10,516	12,343	13,282	14,186	15,050
	Peak Load	10,272	10,749	11,302	11,962	12,612
	Margin of Reserve	244	1,594	1,980	2,224	2,438
REGION III	Capability	7,828	8,614	9,564	10,562	11,266
	Peak Load	7,545	8,240	8,835	9,562	10,234
	Margin of Reserve	283	374	729	1,000	1,032
REGION IV	Capability	7,179	7,976	9,006	9,505	9,945
	Peak Load	6,773	7,348	7,750	8,162	8,539
	Margin of Reserve	406	628	1,256	1,343	1,406
REGION V	Capability	3,430	4,209	4,896	5,667	5,918
	Peak Load	3,137	3,644	4,065	4,409	4,737
	Margin of Reserve	293	565	831	1,258	1,181
REGION VI	Capability	1,672	1,933	2,136	2,403	2,451
	Peak Load	1,554	1,686	1,811	1,953	2,073
	Margin of Reserve	118	247	325	450	378
REGION VII	Capability	4,186	4,731	5,180	5,758	6,011
	Peak Load	4,180	4,516	4,849	5,124	5,497
	Margin of Reserve	6	215	331	634	514
EAST DIV	Capability	807	935	998	1,137	1,182
	Peak Load	780	863	953	1,012	1,061
	Margin of Reserve	27	72	45	125	121
WEST DIV	Capability	3,379	3,796	4,182	4,621	4,829
	Peak Load	3,400	3,653	3,896	4,112	4,436
	Margin of Reserve	−21	143	286	509	393
REGION VIII	Capability	5,229	6,378	6,909	7,735	7,956
	Peak Load	4,840	5,400	5,850	6,300	6,700
	Margin of Reserve	389	978	1,059	1,435	1,256

* Median hydro conditions assumed.



estimate almost certainly is low.

Estimated 1952 installations, announced formally for the first time, represent only those additions definitely programmed at this time. The total of 4,349,000 kw will be swelled as many systems further develop their plans for construction within and beyond the six-year program. With the equipment bottleneck broken—manufacturing capability is now estimated at 8 million kw of steam turbine capacity and 2 million kw of hydro annually—power companies no longer are forced to plan so far ahead as previously. As a result, many systems are ironing out engineering, financing, and other details before making firm commitments for new equipment.

The industry anticipates little tailing off of energy demands, as indicated by the accompanying tables on capability and peak loads. After this year's jump of 7.5%, annual increases in peak loads of 6.2%, 6.1%, and 5.6% are foreseen for the next three years. The 1948-52 increase in peak load requirements, from 51,435,000 kw to 65,774,000 kw—roughly 20%—indicates no downswing in demand, which has surged steadily since the war.

Greatest regional jump in peak load is foreseen for Federal Power Commission Region V (the Southwest), where the 1948-52 total is expected to rise some 51%. Despite this increase in load, the area anticipates a reserve margin of 24.9% by the end of 1952.

Even the Pacific Northwest (Region VII) is expected to squeeze past this year's peak, though its margin of 4.8% will be the narrowest except for the Southeast's. Even this margin will vanish, EEI warned, if adverse hydro conditions prevail in the area. Both the Northwest and the Southeast (Region III) will fall somewhat short of the 15% standard of reserve margin which will be exceeded nationally and in all other regions by 1952.

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Washington Utilities Must Limit Industrial Loads

The Washington State Public Service Commission has issued an order directing privately owned power companies to refuse requests for new or additional industrial loads in excess of 500 kw and also for new or additional power for space heating. Only exceptions are installations "essential to public health, public safety, or national security" or to meet contract commitments.

Municipal utilities and PUD's although not subject to the Commission, are expected to adopt the regulation.

Pacific G&E Requests System-Wide Rate Boost

Pacific Gas & Electric Co has applied to the California Public Utilities Commission for a system-wide increase in electric rates. If granted, the increase will be the first for the company in 29 years.

The utility asked a total boost of $8.9 million in rates, to bring the rate of return on its electric properties to 5% for 1950. The return in 1948 was 4.29%, and the 1949 percentage is expected to be about 4.41.

The application asks an increase of 6% on monthly bills computed at present rates, about 1¢ a day on the average household bill.

The California PUC recently granted PG&E permission to increase its gas rates, stipulating, however, that rates be figured on an "escalator" basis to vary with fluctuating oil prices.

A few days before PG&E's announcement, San Diego Gas & Electric Co stated it would drop its efforts to obtain electric and steam rate increases, substituting a request for higher rates for both household and commercial gas users. H. G. Dillon, vice-president of the company, explained that recent decreases in the price of fuel oil on the West Coast made it possible to discard the earlier plan.

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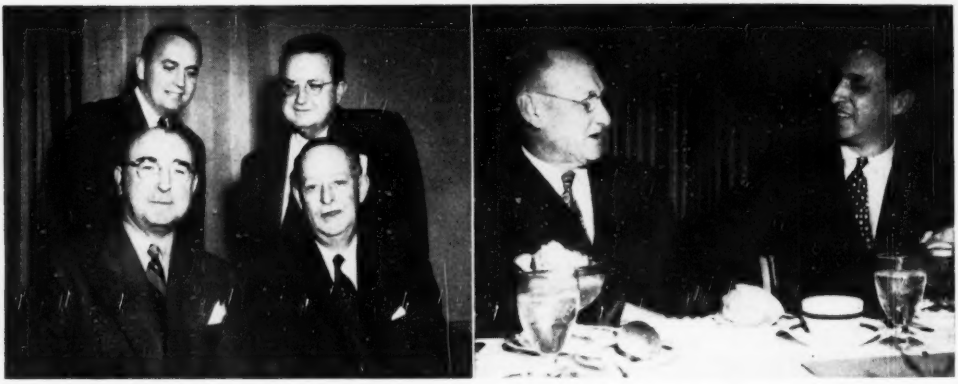
Consent Held Not Needed

A Texas utility need not obtain consent from county commissioners to construct lines along a county highway. The ruling was announced by Attorney General Price Daniel in answer to a question by Enos T. Jones, Floyd County attorney.

FOUR "DEGREES OF ELECTRIC LIVING" from "thrift" to "deluxe" are being shown to public by Indianapolis Power & Light Co and Better Homes Bureau of Westinghouse Electric Corp. Four houses exhibited vary in amount and capacity of electrical equipment. Above is "Budget Degree" home. Attendance was 11,000 the first weekend houses were shown



PROMINENT at SEE Sales Conference were L. R. Boulware, seated left, General Electric Co, and H. M. Sawyer, American Gas & Electric Co. Standing left, Fischer S. Black, editor of "Electrical World", and Chairman Les M. Taylor, vice-president, Mississippi Power & Light Co. In right panel are Charles A. Collier, left, vice-president, and Harllee Branch, vice-president and general manager, both of Georgia Power

Sales Opportunities to Gain or Lose Stressed at Meeting of SEE Group

THE BIG THREAT to American business today is the survival of free markets, L. R. Boulware, vice-president of General Electric Co, told approximately 300 executives attending the opening general session of the Southeastern Electric Exchange Sales Conference, Oct. 26-28, at Atlanta.

Boulware said that this threat to the economic system is the result of unsound government spending, the size of taxes and the manner of their collection, and the spread of false ideologies about the operations of American business.

Fischer S. Black, editor of ELECTRICAL WORLD, in reviewing the outlook for the electrical industry, urged larger trained staffs; more technical understanding of the consumer's needs; more cooperative effort with retailers, wholesalers, and contractors in selling activities; more interest in selling electrical living and less worry about whether it will be a so-called profitable load; and greater advertisement of company services. Black also urged the use of available tools such as community programs and those sponsored by advertising agencies and public relations consultants.

More than 20% of our electric capacity today is in government ownership, and projects are on the drawing board that will increase that 20%, according to Harllee Branch, Jr., vice-president of Georgia Power Co, who spoke at a dinner meeting.

The big bargain in new business for the electric utilities lies in commercial electric cooking, in the opinion of Orrin E. Wolf, vice-president and manager of commercial cooking department of Hotpoint. He said that this business will produce a better power load than any other type of appliance and presents an unparalleled profitable market. Wolf said that one electric fry kettle will produce more earned annual revenue than four electric domestic ranges.

The threat of L-P gas has not lessened, and its annual use has grown from 223 million gallons in 1939 to 2,736-million gallons, Joe Rushton, of Frigidaire, told the conference. During the past three and one-half years there have been as many LP ranges sold in rural and farm areas as electric ranges. The same is true of water heaters, but not electric refrigerators.

Utility companies must search the field for every possible ally—groups which will be mutually benefited from working with them as a team—while striving to accomplish their major objective, said H. G. Isley, Carolina Power & Light Co.

In the Industrial Power Committee session, Don P. Caverly, Sylvania Electric Products, Inc, reported that in the textile industry, infra-red has been applied on slashers where the speed was increased from 25 to 35 yards per minute on the same weight of yarn.

J. Wesley Cable, Consulting Engineer, N. Y. recommended individual voltage regulators for all installations of dielectric heating.

E. B. Karns, Westinghouse, said that mercury vapor can be justified economically over incandescent where .8 ft-c average or higher levels of illumination are required and where street widths are in excess of 40 ft.

The real chief responsibility and function of an industrial power salesman are to peddle all the kilowatt hours he possibly can to every industrial user he has on his system, said D. B. Hyer, Jr., Florida Power Corp.

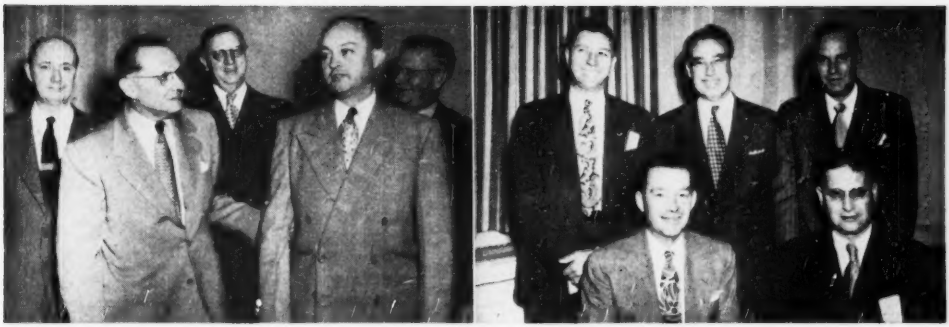
A large number of utility companies are not using sales allies to certain definite advantages, according to W. P. McCutcheon, Birmingham Electric Co. Live contacts and correspondence with trade paper editors are one of the best methods.

Within two years 3-hp heat pump units will be installed for less than $1,000 predicted by U. U. McMillan, of W. W. McMillan & Co, Jacksonville, Fla. A revenue of $34 a year can be expected from the automatic electric laundry according to E. O. George, Detroit Edison Co. who strongly believes in its energetic promotion.

Bud S. Moss, Georgia Power, said that his company's agricultural program has received wide public support. He presented figures during the sessions of the Agricultural Development Committee to show the remarkable increases in yields in many crops which have resulted from company activities.

Carolina Power & Light is working with county agricultural groups and making surveys to further its rural and farm programs, said J. Lloyd Langdon. Appalachian Electric & Power Co, is continuing its splendid rural development program with remarkable results, according to L. L. Koontz.

A main factor in developing a pros-



SPEAKERS at SEE Sales Conference included: Front row, left to right, W. T. Christy, GE Appliances, Inc; Paul D. Brooks, Ebasco Services. Rear row, Joseph Ruston, Frigidaire; John W. Talley, managing director of SEE; and Hugh G. Isley, Carolina Power & Light Co. In right panel: Seated, Percy Miley, South Carolina Power Co; Joseph W. Kling, Georgia Power Co. Standing, J. Mason Guillory, New Orleans Public Service; Henry Keele, Florida Power & Light Co, Miami; and D. B. Hyer Jr, Florida Power Corp, St. Petersburg

perous rural area is use of local crops to supply industry with its needs, in the opinion of J. R. Lester of Alabama Power. Processing more of the raw material to finished product will lift the income of the South.

At the meeting of the Commercial Committee, W. L. Byrne, Ebasco, quoted survey figures—40% more commercial customers and 10% fewer salesmen, today than pre-war. How to sell Planned Commercial Lighting was covered in talks by James Ketch, Nela Park, and Howard Salaun, New Orleans Public Service. Roy Benson, Georgia Power, told how small-town merchants are being helped by his company's community development program. A preview of Hotpoint's new-training program for dealer salesmen was given by D. W. Grosshandler.

How Appalachian Electric & Power increased sales to low-use commercial customers was outlined by R. S. Musgrave. Guy C. Hall, Florida Power, reported on the growth of heat pump installations in his state, and a note of caution on the utilization of ground water for this purpose was sounded by Ralph H. Baker, Florida Health Board.

At the sessions of the Advertising Committee E. N. Pope, Carolina Power & Light, reported utility presidents are meeting with newspaper and magazine editors and discussing industry problems with them.

Another opportunity in public relations is the use of merchandising and load building advertising by selling the company along with the customer benefits of its services, according to Roy Knox, Birmingham Electric.

Clarence M. Kilian, Alabama Power, declared that the advertising man can increase his usefulness to management by interpreting the customer's point of view into management thinking.

Results of Los Angeles Municipal Survey Challenged by Department

AN INDUSTRIAL and administrative survey covering the Los Angeles Department of Water and Power—as required every 10 years by city charter—has recommended a $1.2 million reduction in major appliance promotion. The survey also declared further promotion of industrial sales undesirable because there is "little industrial property available in Los Angeles and also because the possible power revenue and profit will not warrant this type of promotion or the amounts currently expended for this work."

The survey was conducted by Ford, Bacon & Davis, New York, and covered a period from 1940 through the Department's 1949-50 budget.

General Manager Samuel B. Morris and the management of the Department reviewed the survey's 87 conclusions and 56 recommendations and countered with facts indicating that advertising has increased energy usage by residential customers during a 15-year period, from 600 to 1,600 kwhr per year per customer.

Morris said that the 1949-50 sales promotion budget is $300,000 less than last year's, but that electric water heaters, a desirable companion load to ranges, "now have less than one-half the present public acceptance of the electric range, and further promotion of the electric water heater is necessary."

The survey declared that the Department has been able to increase the use of major appliances in Los Angeles to only 3% saturation for water heaters and 7% for electric ranges and that this "indicates that natural gas has a strong economic appeal".

The Department's management said that while gas may have an economic appeal, factors other than cost have as great or greater influence. It was pointed out that there are five times as many electric as gas refrigerators within the Los Angeles area, and that range and water heater saturation quadrupled over the 15-year period.

The Department's management reported also that there are some 19,200 acres of potential industrial land—either already zoned industrially or proposed—and only 10,650 acres are actually being used by industry. It was pointed out that economical expansion of residential loads cannot come about without balance from industrial and commercial customers.

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Heads Alabama Power

James M. Barry, vice-president of Alabama Power Co since 1926 and general manager and director since 1932, has been named president of the utility. He succeeds Thomas W. Martin, who was elected chairman of the board.

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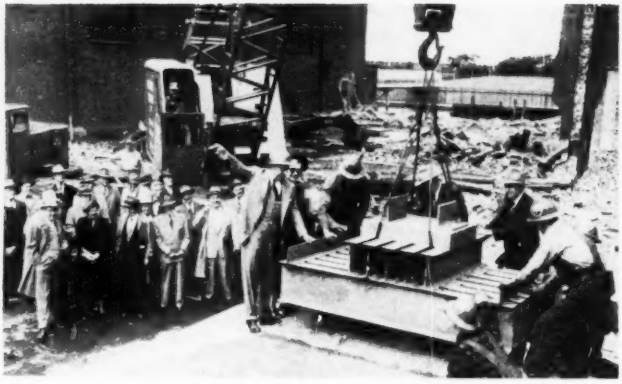
Named to Commission

John M. Campbell, Baddeck, has been named to the Nova Scotia Power Commission to succeed the late J. W. Smith.



SIGNAL FOR LOWERING a steel grillage into position is given by Elmer L. Lindseth, president, Cleveland Electric Illuminating Co, to start construction work on a $20-million addition to company's E 70th Street Lake Shore Plant. Two new 75,000-kw generators, one scheduled for service late in 1950 and the other the following year, will increase system capacity to over 1.1 million kw. Utility will spend $140 million on expansion

Use of Lightning Arresters Studied at Equipment Symposiums of PEA

APPLICATION of lightning arresters to metal-clad switchgear and their use for the surge protection of generators were the subject of symposiums at the fall meeting of the Electrical Equipment Committee of the Pennsylvania Electric Association, Oct 27-28, at Sunbury.

Upwards of 50 engineers representing utility and electrical manufacturing companies in Pennsylvania and nearby states attended the conference which featured an inspection of Pennsylvania Power & Light Co's new 150,000-kw Sunbury generating station, the newest and one of the largest hard-coal burning stations in the United States.

That lightning arresters are essential to the adequate surge protection of generators was the discussion concensus of the subject by E. M. Hunter, General Electric Co, and A. A. Johnson, Westinghouse Electric Corp. Use of reduced rated arresters with generators having their neutrals solidly grounded was similarly sanctioned by both speakers, however Johnson felt that solidly-grounded generator neutrals were a "good thing to avoid".

Individual machines in a unit generating system should preferably be grounded through the primary of a distribution transformer having a resistor across its secondary, Johnson said. Hunter, on the other hand, preferred a potential transformer grounding scheme on the basis of past favorable experience. In stations where two or more machines are connected to a single bus, Johnson felt that resistance or reactance grounding was preferable since it provided means for telling which machine was in trouble.

In explaining a recent case of arrester failure which had apparently taken place simultaneously with the occurrance of a ground fault on one phase of generator cable leads, Johnson pointed out that arresters almost universally fail when a higher than rated voltage that they cannot valve off is applied across them. In the case at hand, a nail hole in the cable, apparently sustained during installation, had presumably led to the cable fault. When the generator rejected load at full excitation, an abnormally high voltage appeared across arresters in the unfaulted phases, causing failure of one of the associated arresters.

Engineering representatives of three firms that manufacture metal-clad switchgear participated in a second symposium on the application of lightning arresters to switchgear. All three discussers appeared to agree that use of arresters with metal-clad switchgear was desirable for the protection of associated equipment. Minor differences of opinion developed, however, as to whether station-type of line-type arresters should be used and whether arresters should be installed inside or outside the metal-clad switchgear. E. M. Hunter, GE, favored use of station-type arresters on 15-kv metal-clad switchgear but not on 5-kv equipment. His preference was for enclosure of the arresters. H. B. Wortman, Westinghouse, favored the use of line-type arresters inside the gear while T. A. Sillers, Allis-Chalmers Manufacturing Co recommended the use of arresters with metal clad switchgear but preferred that it be installed outside the gear itself.

An illustrated discussion of the design of Sunbury Station was presented at a luncheon meeting of the committee by W. B. Morton, station electrical engineer, and H. F. Hatfield, mechanical research engineer, Pennsylvania Power & Light Co, as a prelude to a tour of the new station by the committee. This station, located on the Susquehanna River outside Sunbury, houses two 75,000 kw turbo-generators operating on steam at 1,380 psi 950 F from boilers burning anthracite silt. Soft coal is used for starting. One of the two units is now in operation.

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Addition Ups Capacity of Coulee to 1,316,000 Kw

Installed rated capacity of the Grand Coulee Dam power plant has been increased to 1,316,000 kw with the beginning of commercial operation by the twelfth 108,000-kw generator. Peaking capacity is about 1,500,000 kw.

The generator is the third to be completed in the east powerhouse this year, with three more of the same size to be assembled next year, and the final three in 1951. The generators are the world's largest, carrying peak loads approaching 130,000 kw.

With all 18 generators operating in 1952, the installed rated capacity will be 1,974,000 kw, including 30,000 kw from three small station-service units, and the peaking capacity 2,280,000 kw.

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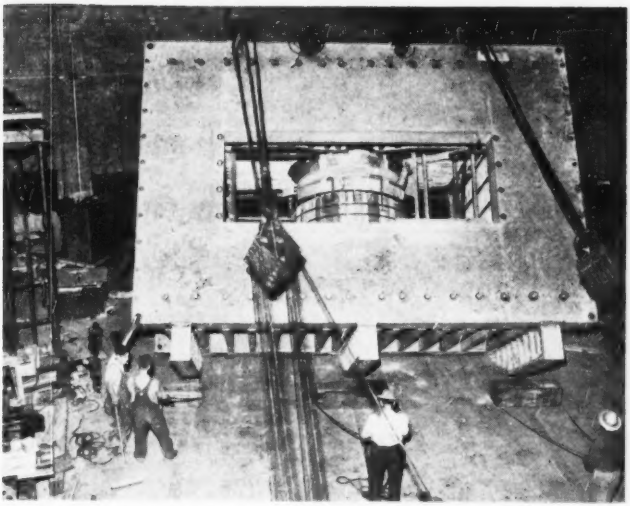
Interconnection Okayed

Maintenance of a permanent interconnection for emergency use between the generating facilities at E. I. du Pont de Nemours & Co's nylon production plant at Orange, Tex., and the transmission facilities of Gulf States Utilities Co has been authorized by Federal Power Commission. The interconnection will provide up to 2,000 kw of power to Gulf States. Approval extends until Dec 31, 1950, or until an earlier end to the emergency on the utility's system.



CORE of 300-million-v betatron now in final stages of construction at the University of Illinois, Champaign, is tipped up after having been assembled flat from 70,000 sheets of transformer laminations .014 inches thick in 5,000 layers. Core weighs 275 tons. The equipment will be used in atomic research. Still to be added are six 12-ton field magnets and the vacuum tube, source of high-energy X-rays for meson study

Kentucky Co-op Gets PSC OK to Bargain for Utility

The Kentucky Public Service Commission has finally made up its mind about two things:

1. It has the power to say who can buy a utility.

2. The Jackson Purchase Rural Electric Cooperative, Paducah, has its permission to negotiate with L. A. Solomon the purchase of his Calvert City electric plant and system for $78,000.

Point 3 is in the hands of Solomon. He has the right to keep his plant.

Early this year the Kentucky Utilities Co made the same $78,000 offer. Solomon was willing to sell. The utility then approached the PSC for permission to make purchase. The co-op fought the proposal and made an equal offer.

The company then argued that its petition was only a matter of form and that the Commission had no power to rule on the sale. The co-op said it had. The Commission at first sidestepped the issue but finally laid down its recent ruling.

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Offer Promotion Folders

Two direct mail folders for use by utilities in promoting Planned Lighting to service stations have been prepared by Edison Electric Institute. Entitled "How's the Night Life in Your Business?" and "How to Bring Customers in to Buy," they stress the importance of profitable night-time business to successful service station operation. Copies may be ordered from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y., at $9 per 100 set of two.

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Must Sever Systems

Joint operation of the Cheney, Wash., power system, owned by the City, and the telephone company, owned by Charles Lund of Spokane, will end Dec 31. Decision to separate the two services was precipitated by the state auditor's office, which notified the City of legal barriers to ownership and operation of telephone companies by municipalities. The joint operation has been in effect since 1931.

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Brooklyn in the Dark

Some 40,000 Brooklyn consumers of Consolidated Edison Co were left in darkness Oct 26 as a result of a substation fire. A short circuit put out of commission twenty-three 4-kv lines. Service was restored to all consumers about ten hours later.

Sales of Energy in July Advanced 3.1% over '48

Sales of electric energy to ultimate customers in July totaled 19,960,312,000 kwhr, Edison Electric Institute reports. This was a 3.1% increase over the 19,367,345,000 kwhr sold in July, 1948.

Revenues from ultimate customers amounted to $375,418,900 in July, an increase of 7.8% over the $348,380,100 reported for July, 1948.

Classification of Sales, July

Kilowatt Sales July	Million Kwhr 1949	1948	Percent Change
Residential or domestic	4,419	3,823	+15.6
Rural (Distinct rural rates)	825	637	+29.6
Commercial or industrial			
Small light & power	3,975	3,653	+8.8
Large light & power	9,533	10,035	−5.0
Street & highway lighting	184	170	+8.5
Other public authorities	516	489	+5.5
Railways & railroads			
Street & interurban	275	305	−9.8
Electrified steam railroads	187	203	−7.8
Interdepartmental	46	53	−12.7
Total, to ult cust.	19,960	19,367	+3.1

For the 12 months ended July 31, the average use per residential customer increased to 1,635 kwhr, and 8.1% increase over the 1,513 kwhr of the previous year; the average annual bill to $48.56 from $45.84, an increase of 5.9%. Revenue per kwhr dropped to 2.97¢ from 3.03¢, a decrease of 2.0%.

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Utility Awarded Contract

Washington Water Power Co has been given a new five-year contract to supply power to the municipal system of Chewelah, Wash. Mayor A. W. Birge said, "The fact that Chewelah would lose the right to administer its own light department and still be unable to lower rates for from six to eight years was discouraging so far as accepting Bonneville power offers was concerned. Even though the city would save money on the actual purchase of power, it would ne necessary to levy other taxes to support the departments which are being subsidized by the light department."

•

New Service Company

Commonwealth Services, Inc. has taken over the accounts formerly handled by Commonwealth & Southern Corp. There will be no change in personnel, and offices will be maintained at 20 Pine St, New York, and at Jackson, Mich.

FPC Voluntarily Drops Jurisdiction As SEC Priority Over State Upheld

FEDERAL POWER Commission bowed to state jurisdiction last week while Securities and Exchange Commission's right to override state laws was upheld by a federal court.

FPC resolved what it termed a "perfect impasse" in the laws governing regulation of utility securities by disclaiming jurisdiction over a proposed stock issue of Kentucky Utilities Co. The utility had requested either this action or approval for issuance of 25,000 shares of 4¾% preferred stock of $100 par, to be underwritten, and 165,000 shares of common stock to be offered to stockholders and employees.

Kentucky Public Service Commission, in approving a similar application made to it, had held it had sole authority over the issue. FPC agreed. The federal commission in its Oct 25 order pointed out that although the Federal Power Act exempts cases where a public utility's security issues are regulated by a state commission, the statute under which the PSC was established also contains an exemption covering security issues which are regulated by a federal agency. Noting that by the literal language of the two laws a perfect impasse would be established, FPC said it would construe the Federal Power Act as not intended to apply "in a situation like the present."

"This construction," FPC said, "we believe to accord with what we conceive to be the policy of Congress not to provide federal regulation of a security issue where, absent such regulation, statutory provision for Commission regulation by a state in which the public utility is organized and operating will be operative."

In the SEC case, the federal agency's plan for merger of Sioux City Gas & Electric Co and its affiliate, Iowa Public Service Co, was approved by Federal District Judge Henry N. Graven despite objections by Iowa's first assistant attorney general, Don Hise, who contended that the SEC proposals did not conform to state statutes in provisions related to stockholder voting. The judge held it was not necessary for SEC-approved plans to observe state laws on stockholder veto of mergers.

Under the approved plan the two utilities will be combined into a single company, Iowa Public Service Co. Three other Sioux City G&E affiliates, South Dakota Public Service Co, Nebraska Public Service Co, and Yankton Gas Co, will be dissolved and merged into the new three-state utility.

FINANCIAL BRIEFS

Subscription rights expire Nov 3 for 239,601 additional shares of Illinois Power Co common stock, being offered to stockholders at $31.50 on a one-for-eight basis.

The number of General Electric Co stockholders increased by 2,214 in the year ended Sept 23. The new total of 251,064 stockholders is an increase of 1,725 over the number recorded as of Dec 17, 1948. Of the stockholders 87% are individuals, 10.7% "trustees, guardians and other fiduciaries," and less than 2% business enterprises.

Consolidated Edison Co of New York has arranged with 15 New York banks for a $50-million credit, to run until October, 1950. Borrowings will be made for construction and in anticipation of permanent longterm financing. A $70-million credit with the same group of banks expired Oct 14.

Higher Rate to Cut Down Resales Denied in Boston

Boston Edison Co's petition for higher electric rates to owners of buildings who resell power to tenants has been rejected by the Massachusetts Department of Public Utilities.

Object of the proposed rate hike was to discourage resale, particularly to non-tenants of Edison customers. Edison gross revenues would have increased more than $1 million annually if all tenants now buying from building owners had bought their power direct. The company had said it would use this gain to reduce the cost of electricity to domestic customers.

The Commission held a rate should not be fixed solely on the purpose for which the energy is to be used. However, it forbade expansion of the resale practice. Commissioner Edward N. Gadsby, though approving the decision, said the resale problem should be faced at once and the practice forbidden now if discontinuance of reselling were the ultimate goal.

SEC RULINGS

Florida Power & Light Co has been granted permission to amend its agreement of consolidation to provide that the utility's board of directors shall not make or alter any bylaws fixing their number, qualifications, classifications, or terms of office, or change the number of shares required to constitute a quorum for a stockholders' meeting (Release No. 9429).

Texas Electric Service Co's proposal to sell $8 million of first mortgage bonds 2⅞% series due 1979 has been approved, and the Commission has released its jurisdiction over the fees and expenses involved (Release No. 9430).

Central Maine Power Co's financing proposal has received SEC clearance, subject to the results of competitive bidding. The company will issue and sell $5 million of first and general mortgage bonds, Series S, due Nov 1, 1979; 30,000 shares of dividend series preferred stock at $100 par; and 200,548 share of common stock at $10 par. The common stock is to be offered to present stockholders on the basis of one new share for each 10 common shares held and one new share for each two preferred shares. New England Public Service Co, parent, will waive its rights (Release No. 9445).

United Corp has received SEC authorization to distribute to its common stockholders as a special capital dividend 1/10 share of Niagara Hudson Power Corp common stock for each share of United common. The distribution, involving a reduction of United's interest in Niagara Hudson from 28.5% to 14.1%, is said to be "in further compliance" with a 1943 order of the Commission to cure various complexities and inequitable distributions of voting power within its system. As a condition to approving the plan SEC ordered United to "undertake promptly" to file a "comprehensive plan" setting forth the remaining steps to be taken in transforming United into an investment company, with a timetable for these steps. The plan, SEC said, should cover three questions: The action required of United in ceasing to be a holding company "with respect to its present and former subsidiaries", assurance of fairness to security holders in the conversion to an investment company, and treatment of option warrants (Release No. 9431).

Central and South West Corp has been granted SEC permission to offer 725,567 shares of $5-par common to stockholders of record Nov 2 at the rate of 1 for 10. The approval was granted pending granting of authority by Arkansas Public Service Commission and recording of results of competitive bidding. The company will use the proceeds for further investment in subsidiaries (Release No. 9447).

Iowa-Illinois Gas & Electric Co has obtained SEC release of jurisdiction with respect to results of competitive bidding on its issue of $10 million of first mortgage bonds due 1979. The bonds are being offered at 101.02% of the principal amount plus accrued interest (Release No. 9452).

Output Increases Slightly Despite 2 Major Strikes

Despite the coal and steel strikes, the nation's electric energy output for the week ended Oct 29 rose slightly over the previous week.

The amount of electrical energy distributed by light and power companies for the week ended Oct 29 amounted to 5,432,753,000 kwhr, a decrease of 2.2% below the 5,555,254,000 kwhr distributed during the same period last year. The decrease from last year was only slightly more than the decline from 1948 reported last week.

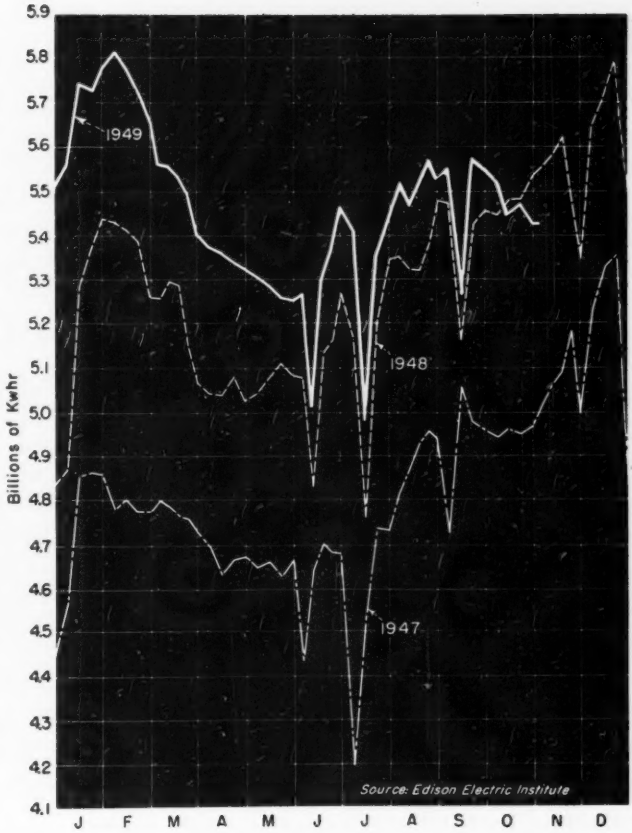
Revised figures for the week ended Oct 22, reported by Edison Electric Institute, show a total output of 5,430,338,000 kwhr, 2% below 1948. The revision showed a 2.1% rise above 1948 for the New England states instead of the 2.2% decline originally reported.

Weekly Output, Millions Kwhr

1949		1948		1947	
Oct 29	5,433	Oct 30	5,555	Nov 1	5,009
Oct 22	5,430	Oct 23	5,539	Oct 25	4,964
Oct 15	5,481	Oct 16	5,482	Oct 18	4,946
Oct 8	5,450	Oct 9	5,482	Oct 11	4,958
Oct 1	5,521	Oct 2	5,449	Oct 4	4,935
Sept 24	5,556	Sept 25	5,461	Sept 27	4,956
Sept 17	5,579	Sept 18	5,426	Sept 20	4,977
Sept 10	5,258	Sept 11	5,166	Sept 13	5,053
Sept 3	5,544	Sept 4	5,470	Sept 6	4,721
Aug 27	5,523	Aug 28	5,478	Aug 30	4,940
Aug 20	5,579	Aug 21	5,391	Aug 23	4,953
Aug 13	5,530	Aug 14	5,318	Aug 16	4,923

Percent Change from Previous Year

	Oct 29	Oct 22	Oct 15
New England	+ 3.0	+ 2.1	+ 3.8
Mid-Atlantic	— 2.0	— 3.3	— 1.4
Central Industrial	— 9.8	—10.9	— 9.5
West Central	+ 2.1	+ 0.5	+ 1.2
Southeast	— 3.4	— 2.4	+ 3.8
South Central	+ 7.9	+11.6	+11.3
Rocky Mountain	— 1.7	+ 1.7	+ 3.8
Pacific Coast	+ 4.9	+ 7.8	+ 7.4
Total United States	— 2.2	— 2.0	— 0.0



Reclamation Plans Call for 146.5Mw at Kings R

First plans for power development of the North Fork of Kings River in California, as an addition to the Central Valley Project, have been drawn up by the Bureau of Reclamation. Interior Secretary Krug sent them to the Governor of California, the Secretary of the Army, and other federal officials.

Total rated capacity of 146,500 kw is foreseen by Reclamation from the following developments:

Haas Power Development and Pine Flat Power Plant, 45,000 kw each; purchase of the privately owned Balch Power Development, with increase in existing capacity from 31,500 to 52,000 kw; and a 4,000-kw plant at Wishon Dam.

Entire cost of the hydroelectric and other proposed construction, said to be repayable, is estimated at $82,745,000.

MEETINGS

National Electrical Contractors Association
Annual Conference, Rice Hotel, Houston, Tex., November 8-11.

National Electrical Manufacturers Association
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.

Refrigeration Equipment Manufacturers Association
All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City Auditorium, Atlantic City, N. J., November 14-18.

★**Pacific Coast Electrical Association**
Annual Fall Conference, Hotel Californian and Hotel Fresno, Fresno, Calif., November 17 and 18.

New Jersey Utilities Association
Annual Meeting, Seaview Country Club, Absecon, N. J., November 17-19.

Wisconsin Utilities Association
Joint Annual Convention, Electric and Gas Sections, Schroeder Hotel, Milwaukee, November 21-23.

★**American Society of Mechanical Engineers**
Annual Meeting, Hotel Statler, New York, N. Y., November 28-December 2.

Exposition of Chemical Industries
Grand Central Palace, New York, N. Y., November 28-December 3.

American Society of Refrigerating Engineers
Annual Meeting, Edgewater Beach Hotel, Chicago, Ill., Decembre 4-7.

American Society of Agricultural Engineers
Winter Meeting, Stevens Hotel, Chicago, Ill., December 19-21.

National Farm Electrification Conference
Stevens Hotel, Chicago, Ill., December 20-22.

★**Canadian Electrical Association**
Annual Winter Conference, Chateau Frontenac, Quebec, January 16-18.

Plant Maintenance Show and Conference
Auditorium, Cleveland, Ohio, January 16-19.

Southwest Air Conditioning Exposition
Hall of Agriculture and the Poultry Building, Fair Park, Dallas, Tex., January 23-27.

American Society of Heating and Ventilating Engineers
Annual Meeting, Adolphus and Baker Hotels, Dallas, Tex., January 23-27.

★**American Institute of Electrical Engineers**
Winter General Meeting, Hotel Statler, New York, N. Y., January 30-February 3.

★ Additions this week.

WASHINGTON COMMENT

WILLIAM B. WHICHARD

WHAT THE 81st Congress during its first session did on power matters made, on the face of it, a disheartening record in the eyes of private industry proponents. In dollars, at least, it gave President Truman just about what he wanted for federal power expansion. It granted him important policy concessions, too (EW, Oct 29, p 4).

Truman prodded Congress on the power issue all through the session. His 1948 election success, especially in the conservation-minded West, convinced him of the political popularity of the public power issue. So much so that he already has okayed plans of Democratic leaders to plump hard in 1950 for federal power in New England, as well as elsewhere.

But the record also showed that the 81st Congress was not completely stampeded by the Administration on power. At points, such as the Interior Department's proposed steam generating plant in the Central Valley of California, the Senate grumbled a flat "no." On the Truman-sponsored Columbia Valley Administration, which the Administration forced into hasty hearings, both the House and Senate said, "Let's take a long look at this thing." One might also read some significance in the Senate's rebuff of Leland Olds, who was one of the first to urge Truman to adopt public power as a campaign issue last year. One might, that is, if a weary Senate had not then approved for Olds' Federal Power Commission job Ex-Gov Mon Wallgren, whose only visible qualification was his long friendship with the President.

At any rate, the 81st Congress demonstrated that it was not prepared to permit indiscriminate federal construction of steam generating plants. Rightly or wrongly, it made an exception for the Tennessee Valley Authority—but only after an extended and searching debate. In holding the line against CVA, despite almost unprecedented pressures, it served notice that it was well aware of the surrender of Congressional prerogatives incumbent upon the creation of any new valley authority.

On these two points, at least—federal steam plants and valley authorities—the 81st Congress can be expected to move cautiously, even in the face of the 1950 elections.

Meanwhile, an even more important development—for the utility industry—is taking shape as a result of one of Congress' negative actions. This is the agreement, or series of agreements, now being discussed by Southwestern Power Administrator Douglas Wright and Southwestern utility spokesmen.

Congress gave Wright authority to undertake a $9-million program of construction of transmission facilities. But the Senate made it pretty clear it expected Wright and the utilities in the SPA area, both of whom expressed willingness, to try to work out an agreement that would eliminate any need for SPA transmission lines.

Congress, especially the Senate Appropriations Committee, also listened appreciatively to offers by other company executives to make similar deals with other federal power agencies. There isn't any doubt that the "deals," if any, will take the form of the once-detested "wheeling agreement." Without going into the merits of wheeling federal energy or the lack of them, the industry must recognize that it—or an important segment of it—is now committed to try such an arrangement. And, good or bad, it is a resolution, if it's possible, of many of the worst rows betwen the industry and government.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Auxiliary reliability is almost positively assured for the power plant if three sources are cultivated, (1) off the high-voltage bus, (2) off the generators, (3) off a nearby subtransmission system.

Aerial cable thermal ratings are not well established and the range of manufacturers' recommendations is at least 20% for similar conditions.

Outdoor-sootblower air should probably be dried by, say silica gel, before being used for controlling and moving the heads.

Capacitors are fine tools but it should not be overlooked that the raising of power factor and voltage can be conducive to generator instability unless they are switched off during light-load periods.

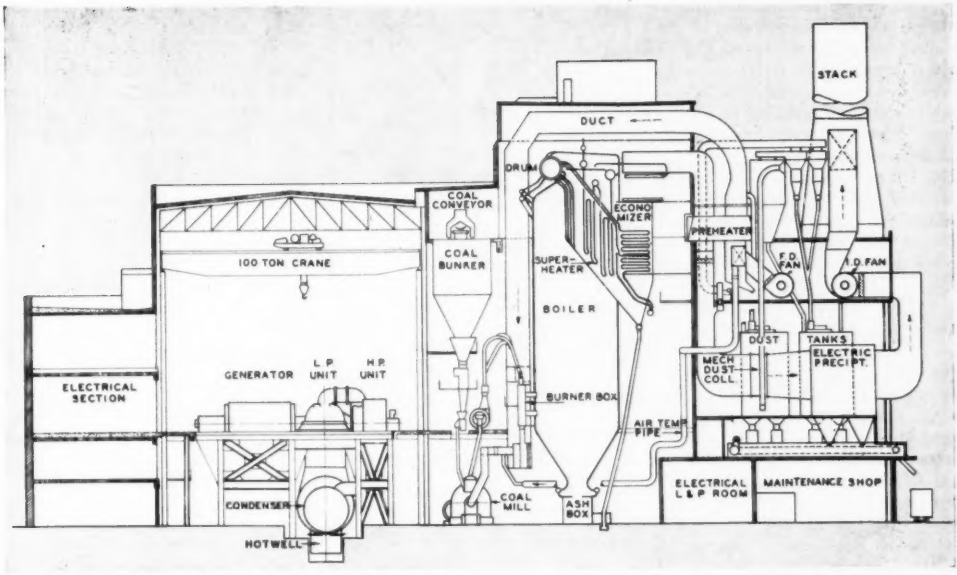
Over-voltage tests up to 150% of rated value do not, even if repetitive, weaken alternator coil windings: machines so subjected have shown no acceleration of subsequent winding failures.

Brush was not so inept a name when composed of bundled wire or gauze: carbon brushes are thus possibly "collectrodes."

Distribution transformers on 22 utility systems with over 2½ million customers averaged 5.8 customers per transformer.

Rotation of an incandescent carbon disk promises to give doubled searchlight brilliancy and longer electrode life.

Preferred conductor sizes for aerial cables are apparently as lacking in sense and uniformity as the open-wire conductor situation was in the early days of power.



CROSS SECTION of Barbadoes station showing a 60,000-kw hydrogen cooled turbogenerator and its 600,000 lb per hour boiler

Standardization Motivates Barbadoes Station Design

Use of standard components in expansion of Barbadoes Station saved time in early negotiations for machines, also brought financial advantage. Two new units boost capacity from 48,000 to 180,000 kw

C. C. FARRELL, Electrical Engineer, and J. H. HARLOW, Mechanical Engineer, Philadelphia Electric Co, Philadelphia

DECISION to use equipment, built to industry-approved standards, in the recently-completed expansion of Barbadoes Generating Station from 48,000 kw to 180,000 kw was one of the dominating factors not only in the design of this plant—as will be shown—but in its cost and the timing of its completion.

The very heavy load growth that followed the war had made it evident by mid 1946 that additional generating facilities, beyond the initial 300,000 kw installation then being added at Southwark Plant would be needed to meet the load expected on this system late in 1948 or early in 1949.

Time was, therefore, an important element in decisions affecting new facilities. Manufacturers were short of materials and their schedules for production of new equipment crowded. There was time to be saved both in negotiation stages and the manufacturer's shops by selecting equipment built to industry standards. There was also a definite financial advantage.

The 60,000 kw 80% power factor machines in the AIEE-ASME Preferred Standard Ratings actually could be used to advantage at the company's existing Barbadoes Station located on an island in the Schuylkill River opposite Norristown (Fig 1). This plant, which was built in 1923-24, contained a 23,000-kw and a 25,000-kw unit and four 1,680-hp boilers supplying steam at 285 psi and 615 F. It was primarily used as a peak load plant. But because Barbadoes is tied into the nearby 220/-66/33-kv Plymouth Meeting substation by two 66-kv and two 33-kv lines, new efficient units there would not only permit base load operation but firm up service to an important area

with rapidly increasing load. Generating capacity could also be installed here without requiring additional transmission facilities, something that could not be done at any other existing or proposed generating site. Such factors as these made Barbadoes Island an attractive location for additional generation. The decision was accordingly made to install two standard 60,000 kw, 80% power factor machines with a capability of 66,000 kw at 93% power factor.

Sub-transmission in suburban Philadelphia is mainly 33 kv. Adjacent to Barbadoes is a 33-kv substation supplying a dozen outgoing 33-kv lines (Fig 2). Board studies indicated that by connecting the new generation through transformers direct to the 33-kv bus, over 60% of the total station capacity would go out over the 33-kv subtransmission system. Two existing 45,000-kva 33/66-kv transformers provide a connection to the 66-kv system of sufficient capacity to take care of generation in excess of that load distributed at 33 kv.

The 33 kv substation at Barbadoes was double bussed. Additional sections had to be provided for the new transformer connections. Existing 33-kv breakers were inadequate for the duty imposed by phase-to-ground faults and had to be replaced. In making the changes a single bus was substituted for the old double bus and sectionalized through two 33-kv oil circuit breakers in the center.

A set of three 6% 1200-kva, 34.5-kv reactors was required between these breakers to keep the fault duty on the line breakers within the capacity of the 1,200-amp, 1,500,000-kva breakers, the largest obtainable (Fig 2). Three percent 900-kva reactors have been installed on certain outgoing industrial lines to provide protection for customers' equipment where it is located within a mile and a half or two miles of the generating station.

Both the old and the new 13.8/34.5-kv transformers have been located close to the generating station wall approximately 150 ft from the 33-kv substation. This limits the length of 13.8 leads from the generators and lessens the possibility of oil fire at the transformers causing any damage to the outdoor substation. Connection between the transformers and the substation is by means of 34.5 kv underground cable so that none of the outgoing lines need to cross over the substation supply connections.

Connections between the generator terminals and the transformers are metal enclosed leads rated 3,200 amp, manufactured by the Railway and Industrial Engineering Co. This type of generator lead was selected after a study indicated that there was little cost advantage in using the conventional cables and that there was considerable physical advantage in the use of the metal-enclosed leads.

The new section of the plant is arranged on a unit basis for simplicity of design. Essential turbine and boiler auxiliaries for each of the new units is supplied from a transformer which is directly connected to the generator leads between the generator and the main transformer so that each unit provides power for its equipment (Fig 3). In addition, there are two 7,500 kva, 34.5-2.3-kv transformers which supply the other station light and power and also emergency service to the turbine and boiler auxiliaries normally fed by the transformers connected to the generator leads.

In planning the lighting the standards worked out in connection with

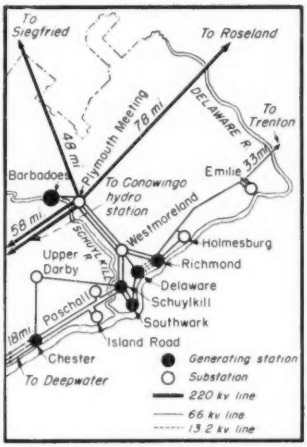


FIG 1—LOCATION of Barbadoes Station with respect to other generating stations and bulk power transmission lines of Philadelphia Electric system. Barbadoes additions firmed service to area of increasing load along Schuylkill River northwest of Philadelphia

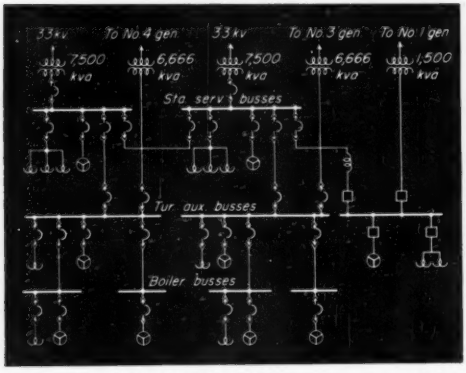


FIG 2—AUXILIARY POWER SUPPLY for equipment of each Barbadoes unit is self-provided through a transformer connected to generator leads. All auxiliarry busses and switchgear are metal-clad

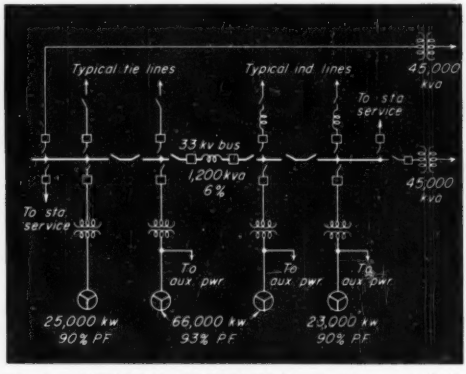


FIG 3—GENERATOR CONNECTIONS and diagram of 33-kv substation at Barbadoes Station. New 13.8-kv generators are connected directly to a 33-kv bus through a 75,000-kva transformer

the Southwark project were used. In the control room 45 ft-c have been obtained on the flat surfaces, such as the desk and 12 to 18 ft-c on the vertical surfaces, such as the switchboards. These values are those measured after being in service for some time. This has been accomplished by using luminous ceiling of Plexiglas panels with cold cathode as the light source. Throughout the rest of the station the illumination ranges from 20 ft-c in the areas where there is high speed rotating equipment, such as the location of the boiler feed pumps, circulating pumps and similar equipment to 5 ft-c in some of the boiler room areas.

Accompanying illustrations show a cross section and plan of the new plant which is an extension to the old plant and contains two 60,000-kw AIEE-ASME Preferred standard turbo generators operating at 850 psi and 900 F. The generators are hydrogen cooled 3,600-rpm machines. Unit arrangement is followed and each turbine is supplied by a steam generator with a continuous rating of 600,000 lb/hr.

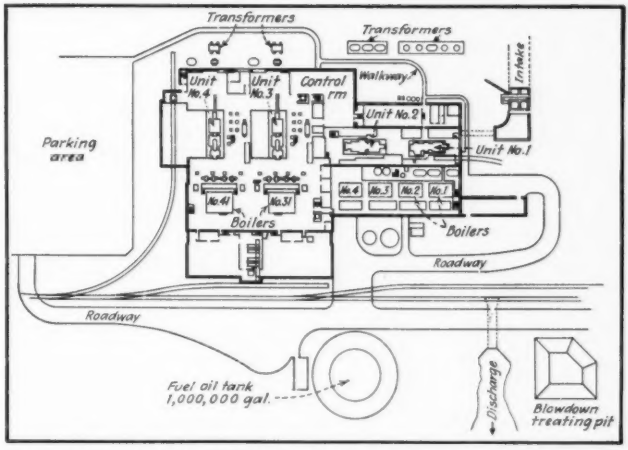


FIG 4—PLAN OF BARBADOES STATION. Station is located on island in Schuylkill River near Norristown. Five million yards of silt of about 6,500 Btu/lb will be dredged from vicinity

Savings from Duplication

Philadelphia Electric Co engineers have believed for many years that power plant costs could be reduced through a reasonable amount of standardization. There are so many variations of machines of one capacity and one set of steam conditions that substantial savings should be possible by duplication. Standard units should also offer advantages in the procurement of replacement and repair parts as well as manufacturing time and machine availability.

It was found that many of these advantages of standardization were realized. This was immediately seen regarding machine availability; the manufacturer, because of his confidence in standardization, actually had two standard units of 60,000 kw size in process at the time this purchase was made.

At Barbadoes the idea of standardization was carried beyond the turbogenerators. While there has been no recognition of such a thing as a standard boiler, boilers were selected for this plant on which the design has been completed for the exact condition of capacity, steam pressure and temperature and feedwater temperature desired. The Barbadoes boilers were made to these drawings with the result that considerable time and probably investment was saved.

Each steam generator is designed for a pressure of 1,100 psi and is capable of producing steam at a continuous rate of 600,000 lb/hr with a four-hour rating of 660,000 lb/hr. There are 15,700 sq ft of boiler heating surface, 8,840 sq ft projected surface of water walls, a 20,750 sq ft superheater, two 9,504 sq ft external heating surface continuous tube economizers and two 72,000 sq ft regenerative air heaters. Maximum heat liberation is 17,000 Btu per hr per cu ft of total volume.

Steam temperature control is of the condenser type. The superheater condenser control valve and the economizer control valve are arranged for either automatic or remote manual control at the control board.

Retractable soot blowers serve the boiler, and rotary blowers are used on the economizer.

Each boiler has two motor driven forced draft fans with direct drive and vane control and two induced-draft fans, motor driven through hydraulic couplings. One stack serves both boilers.

Coal, the normal fuel, is supplied through two double-feeder, double-outlet ball type pulverizers. Bituminous coals ranging from 16% volatile for Central Pennsylvania coal to 35% or more for West Virginia coal are those likely to be used where market or other conditions are favorable. Anthracite is also a probable fuel because the clean-up program of the State of Pennsylvania for the Schuylkill River contemplates removal of very large quantities of river silt containing at least 50% Anthracite fines.

To Burn Cleaned Silt

Within reasonable distance of the plant, some 5,000,000 yards of silt will be dredged having a heating value of about 6,500 Btu/lb as dredged. This can be cleaned to a product with 15% ash and 10,000 or better Btu/lb. Five million yards of silt should produce about 2,000,000 tons of cleaned Anthracite fines. Experiments indicate that a substantial percentage of cleaned material may be mixed with high volatile coal and burned satisfactorily without additional equipment or adjustment. The best way to prepare this material is being studied.

All Philadelphia Electric Co steam stations except Barbadoes are located on tidewater and receive coal by barge over the railroad tidewater terminal piers. At Barbadoes, however, rail delivery only is available. A system of hoppers under two tracks accommodate four cars simultaneously. Eight thaw pits and two car shake-outs are also provided.

Coal is transported by belt and flight conveyor from hoppers to a Bradford Breaker; thence up an in-

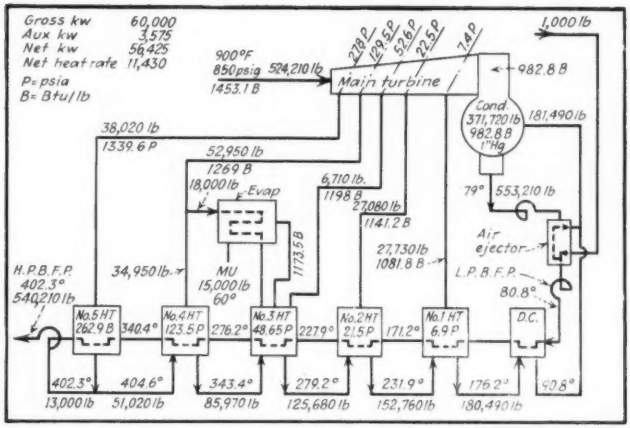


FIG 5—HEAT FLOW DIAGRAM for one of the two units shows heater arrangement

clined belt to the plant or to the storage pile via a diversion chute.

Barbadoes being located on an island in the Schuylkill River at Norristown presented unusual challenges regarding the handling of ash.

To most, the Schuylkill is just another river, but to those who live in eastern Pennsylvania, it is well known as the subject of probably the biggest river clean-up program ever undertaken. The Philadelphia Electric Co heartily approves this program both because of its good neighbor policy and from a selfish standpoint, having much to gain from a clean river. As a consequence of close cooperation with the State authorities a scheme of caring for the plant wastes was worked out as follows:

1. Fly ash, collected dry, is conditioned by dustless unloaders and either hauled away or buried.

2. Ash from dry bottom furnaces is pumped to two settling pits, each approximately 700 x 100 ft. Ash sluice water enters the pits at one end and at the opposite end the pit is equipped with a skimmer wall and overflow weir in addition to a means for decanting. The pits will be used alternately and while one is in service the other will be unwatered and the accumulated material removed.

3. Boiler blowdown and acid water resulting from boiler cleaning is accumulated in an outdoor pit where it is treated chemically and neutralized before pumping to the ash pits.

4. Floor drains are collected in oil separating sumps before entering the river.

5. Plant sewerage is pumped 1,000 ft across the bridge to the sewerage system of the Borough of Norristown.

To reduce the fly ash and stack discharge nuisance to a very minimum two measures were taken: First, mechanical and electric dust collectors were installed in series, the gases entering the mechanical first. By this means about 96% of the flue dust is being collected. The continuous removal system of the mechanical collector has been connected to the electrostatic precipitator. This more-or-less novel arrangement required some adjustment but now appears to be operating satisfactorily. It proved helpful to rap the electric precipitator continuously.

Second, the stack was equipped with a nozzle at the top which at full load accelerates the gases to over 100 fps. This device was first used at Southwark and was very helpful in throwing the stack gases higher on quiet days.

Condenser System

Main unit condensers are two-pass and contain 37,500 sq ft of surface. Tubes are of Admiralty A. Deaeration is accomplished in the condenser hotwell. The intake and screens for the old plant were improved and the tunnel extended to accommodate the two new units. Two circulating pumps rated at 24,400 gpm singly and at 40,000 gpm together are installed with each condenser. The circulating water is intermittently chlorinated for slime control.

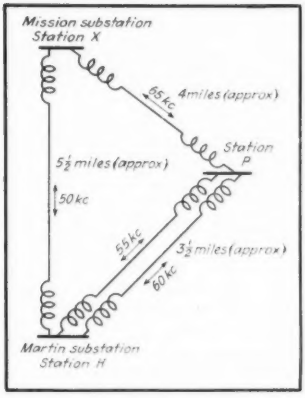
Record minimum flow of Schuylkill River is about 90,000 gpm at Barbadoes. Plant requirements with all units, old and new aggregate 160,000 gpm. Two circumstances make this apparent hindrance to full capacity operation sufferable: (1) Ample flow for full circulating water demand is available more than 95% of the average year. (2) A dam which dates from canal boat days creates a pond around long narrow Barbadoes Island. Therefore, by taking circulating water from one side of the island and discharging it at the other a recirculation distance of nearly a mile is established thus providing a very substantial cooling basin.

Figure 5 shows the calculated Heat-Flow diagram for one of the units and also shows schematically the heater arrangement. There are two condensate pumps, two low pressure boiler feed pumps and two high pressure boiler feed pumps. Each pump is adequate for full load operation of the unit and all are constant speed. Control of the feedwater is obtained through adjustment of the feedwater valve.

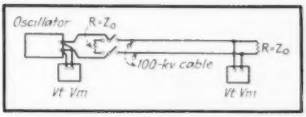
All the feedwater heaters were built so that one tube bundle could be provided as a spare in case of tube failure in any heater. Such a spare tube bundle is provided. With such provision, it was felt reasonable and satisfactory not to provide by-passes around each heater but to provide a single by-pass around all the heaters as a group. The saving in valves, which would be motor operated if installed, is very considerable.

Make-up water is evaporated, zeolite-softened city water from the Norristown mains. Feedwater treatment is accomplished by two sets of chemical pumps. Low pressure pumps deliver sulphite into the feedwater system and high pressure pumps deliver phosphate directly to two boiler drums.

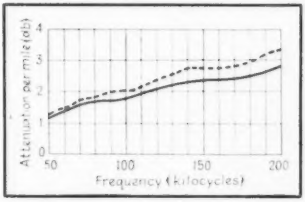
Engineering, preparation of plans and purchase of all apparatus and equipment have been carried out through the cooperative efforts of Engineering, Operating, Purchasing and other Departments of Philadelphia Electric Co. The construction was done by Dravo Corp as construction agent.



POWER LINE carrier channels applied to 110-kv cable of Pacific Gas and Electric Co. Attenuation measurements showed losses well within commercial equipment capabilities



ATTENUATION MEASUREMENTS were made by VT voltmeter on cable terminated in characteristic impedance. Oscillator was calibrated into dummy load for each run



ATTENUATION PER MILE showed small variation from 50 to 200 kc. Upper curve is for phase to ground, lower for phase to phase operation. Carrier operates phase to ground

IMPEDANCE-MATCHING transformers were used with conventional line tuning equipment, carrier coupling capacitors (bottom) and line trap at Mission substation

Power Line Carrier Used On 110-kv Cable

First application follows tests showing low attenuation on gas-filled pipe type cable

R. H. MILLER, Engineer of Communications, Pacific Gas and Electric Co, San Francisco

POWER LINE CARRIER has been successfully applied to 110-kv high pressure gas-filled pipe-type cable for the first time as a result of investigations by Pacific Gas and Electric Co. Measured loss in the cable is well within operating requirements of present-day commercial carrier equipment.

Four cable circuits interconnect downtown San Francisco, the company's high voltage transmission lines and a steam generating station, as shown (also ELECTRICAL WORLD Aug 28, 1948). Before applying carrier controlled ground relay protection to these circuits for rapid clearing of faults and simultaneous breaker operation, it was necessary to determine attenuation of the cable to carrier frequencies.

The cable is 1,000,000 cm, compact segmental, paper insulated, with outer sheath of 7-mil polyethylene tape intercalated with one 3-mil copper tape and covered with two 3-mil copper tapes butted and two copper skid wires 70x200 mils, applied open spiral. Operating under nitrogen gas at 200 lb pressure in a somastic covered pipe, it is rated for 120-kv grounded neutral operation.

Determination of overall attenuation of each cable section and comparison with the loss through which the carrier equipment was capable of working proved the practicability of the application. Field measurement was required, since little has been published on the application of carrier to this type of circuit.

Characteristic impedance at carrier frequencies was calculated after measuring short circuit and open circuit impedance of the sections. The following values were obtained:

Frequency of Test Signal	Phase to Ground	Phase to Phase
50 kc	25 ohms	46 ohms
100 kc	22.5 ohms	44 ohms
150 kc	24.5 ohms	42 ohms

These values indicate that the impedance is constant within measurement limits at carrier frequencies.

Attenuation tests were made by terminating the cable in its characteristic impedance and applying a signal produced by a variable frequency oscillator (see diagram). Input and output voltages developed across the terminating resistors at various frequencies from 50 to 200 kc were measured by vacuum tube voltmeters. Power levels were then calculated from these data.

Measured loss of the cable, as shown in the accompanying curves of cable attenuation per mile, was considerably less than had been anticipated. Carrier equipment on the longest run (approximately 5½ miles) operates at 50 kc, for which frequency the loss of approximately 6.9 db is well within its capability.

Connection and adjustment of the carrier equipment is conventional. Impedance-matching transformers match outputs of the carrier sets to the cable; tuning is by conventional line tuning equipment. Standard line traps and coupling capacitors were installed between high voltage switchgear and cable terminals.

Economic

STREET LIGHT UNIT in place with integral lamp, reflector and electronic control

Experience of Connecticut utility points to expanding use of photoelectric method–Red sensitive, gas filled photo tube improves response to fading daylight

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Engineer
Connecticut Light & Power Co
Waterbury

SOME 1,500 individually-controlled street lights are being installed by the Connecticut Light & Power Co this year. This work is being done as result of generally favorable experience with about 200 photoelectric controls previously installed on a rather experimental basis.

Before the end of the war orders for new street lights were being received in substantial volume. Since the company's facilities for supplying this service were well loaded in most cases, it was obvious that considerable additional equipment and construction would be necessary to meet the demand. As a further complication, many of the requests were for street lights in areas so far beyond existing points of supply that new street lighting systems in these areas would have had to be set up.

The company renders its street lighting service from approximately 140 control points, of which 10 are manually operated and 130 switched by electrically-wound time clocks. Although these clocks avoid the difficulties of re-setting after interruptions characteristic of synchronous clocks, they have their troubles, too, particularly from bearing oil thickening in cold weather. And they have the disadvantage of all time clocks in that they are set for a definite "on" time and cannot recognize the need for earlier turn-on in inclement weather.

Control Requirements

We were thus faced with the need to expand our facilities with a control device which had given service generally not too good. In view of this, it was decided that a thorough investigation should be undertaken into all possible means of street lighting control. The desired control should meet certain requirements:

1. Consistent operation regardless of changing temperatures.
2. Installed cost comparable with similar devices.
3. Operating time not subject to change on account of electric service interruptions at other times.
4. Time of operation to take into account inclement weather and turn on at an earlier hour.
5. Failure should be in the "on" position.
6. Application to individual multiple lamps in order to eliminate circuit costs.
7. Operation on 120-v service.
8. Annual operating costs no greater than existing series systems.

It is not the intent of this article to discuss the pros and cons of series vs multiple street lighting. However, that question does enter into the matter of control to some degree. From a previous study, we had concluded that for the greater portion of our street lighting requirements, multiple supply would be more economical, provided circuits could be eliminated and the losses of the multiple supply held within the limits of the existing series systems. Thus, we entered the

Studies Favor Use Of Electronic Control for Street Lighting

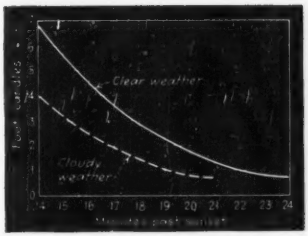
investigation on this premise.

A review of all known devices on the market did not produce anything that fulfilled all our requirements. The nearest approach was an electronic control with several undesirable features, particularly price, but it was rather obvious from this review that the solution to the problem would be found in the field of electronics. In consequence, we consulted with several manufacturers of electronic equipment with the thought of developing a control to meet the requirements we had set.

During the past few years, a few manufacturers developed and placed on the market controls meeting most of the requirements. Operating experience during the past two and one-half years with these early developments was very favorable. The most important unfavorable factor was cost. Since all of these controls had to be installed separate from the fixture, the installed cost was too high for individual lamp use. We finally interested the General Electric Co in the problem and after some investigation they decided to go ahead with the design and development of a unit with the control built into the street light hood. Around the first of this year, such a control was marketed.

Integrated Unit Used

This control is a relatively simple electronic device designed as part of the fixture and operated on 120-v a-c. It plugs into a receptacle in the top of the hood. An IP-40 or 930 red-sensitive gas-filled photo tube actuates the device through a 6SQ7 amplifier tube, which, in turn, causes a 6V6 control tube to operate a 10-amp relay and turn the street light on or off as required by the changing light level to which the photo tube is exposed. Recognition of the need for long operating life had its influence on the design. The tubes as used in this control have operating currents far below rated values and average tube life is expected to be several times the normal rating of 5,000 hr.



TYPICAL CURVES of decline of daylight in Connecticut made with foot-candle meter

The installation of this control requires very little work over and above that for present luminaires. The control should be tested to assure that its operations occur at the light levels desired and is within tolerable limits. The luminaire is installed in the same manner as any multiple fixture. After this is done, it is only necessary to insert the control unit and adjust the control and socket so that the photo tube will point north. After tightening the screws holding the socket, all controls inserted at that location will be properly oriented. While instructions call for orientation to the true north, the magnetic north is more easily located and appears to give very little error in the northern latitudes.

We tested protoypes of this control in the field for several months previous to its introduction. It appears that, with two exceptions, the device meets the requirements originally listed. It cannot be guaranteed to fail in the "on" position. However, in most cases it ought to do so. Second, its annual operating cost is still undetermined because this factor is dependent upon the useful life of the tubes. Time alone will answer that particular question.

Operating Light Levels

One of the first problems was determination of the levels at which the unit was to operate. We observed that at the manually operated control points where the operators are instructed to turn the lights on and off on stormy days when their judgment so indicated, the total yearly burning time averaged slightly less than 4,100 hr. This is some 140 hr in excess of our predetermined schedule of 3,960 hr covering the period of ½ hr after sunset to ½ hr before sunrise, with an allowance for the longer twilight period during the shorter days of winter. Many field tests were made with a color-corrected Weston foot-candle meter and the decay of light from the north sky was plotted against minutes after sunset. Typical curves of these data are shown in an accompanying graph. After much investigation, it was concluded that a level in control operation of one foot-candle would approximate past experience in total burning hours. To accomplish this as the end result, an-

Comparisons of Investments — Individual vs Group Control of Street Lights

Circuit Designations	Descriptions of Circuits								Individual Control in Percent of Group Control Investment		
	2-Wire Underground ft	2-Wire Overhead ft	1-Wire Overhead ft	Number of Luminaires 1,000 L	2,500 L	4,000 L	6,000 L	10,000 L	Luminaires	Supply Facilities	Totals
A	.....	52,500	.....	93	55	36	...	....	125	39	92
B	1,620	16,215	.....	5	11	104	10	....	148	15	88
C	1,703	40,610	.....	21	2	76	25	....	150	26	81
D	.....	65,508	1,500	244	...	33	...	11	127	40	97

other factor had to be considered. One of the characteristics of the IP-40 or 930 photo tube is the tendency to drift to higher levels upon exposure to daylight for a few weeks. This anticipated drift was expected to be in the order of 0.2 ft-c. Taking recognition of this factor, we are setting our controls at 0.8 ft-c anticipating that the 1.0 ft-c level will be reached in due time. Future contemplated field tests of these controls will determine the correctness of this procedure.

In order to obtain information either to prove or disprove the selected level at which the controls are being adjusted, there was set up an accumulated time test. This involved simply installing a control in a convenient location, properly oriented and adjusted. This control operates a self-starting synchronous counter which indicates the accumulated minutes of "on" time over any period. This test unit has been in operation since Jan 1 last. In the period up to June 1, the manually-controlled circuits had 1,708.37 burning hours scheduled, while actual burning hours were 1,738.11, and the test unit counter accumulated 1,757.47 hr. It is difficult to draw definite conclusions until data have been accumulated for at least a full year. We think these figures are favorable. Based upon weather bureau reports for last year, half of the cloudy or stormy days occurred during the period from Jan 1 to June 1.

Experience with 400 Units

After completing installation of approximately 400 units, we ran into a little difficulty. Some of the controls were failing to turn the light on at the proper time and, in some cases not until hours after nearby units had functioned normally. These units were removed and returned to the shop. Upon testing they were found to be out of adjustment in some cases to the extent that even practically total darkness would not cause them to turn on. These units were readjusted and returned to the field and with but few exceptions, they operated satisfactorily. An analysis of this condition indicated that the probable cause was a drift in the emission factor of the 6SQ7 and 6V6 tubes. We then made arrangements for preburning a number of these controls. On checking the turn-on time of controls from day to day we found that the adjusted level did drift in many of the units. There was no definite pattern evident except that none of the units showed any material drift after 100 hr of preburning. We have therefore established the practice of stabilizing the controls by preburning at rated voltage in a northern exposure for approximately 100 hr. Under these conditions it goes through its daily operations, which reduces the possibility of the tubes gasing from inactivity. Since following this procedure, all failures have been from other causes.

No doubt, some question will arise relative to the uniformity in the turn-on time. Field observations have been made to determine this point. In general, a majority of the lights come on within a 3-min period. It is rather difficult to make any definite statement since the shadowing effect of trees, tall buildings and similar structures is not known. In the practical sense, the fact that all of these new street lights do not come on at the same instant is a matter to which the public must be educated.

Tube Life

An outstanding question regarding this control is on the life of the tubes. The only answer to this question will come from experience. The manufacturer estimates that the tubes should last at least three years. The design of the control is based upon long life, through the operation of tubes at less than normal filament voltage and plate current. Another very desirable factor is the constant burning, which is less harmful to the filament and tends to lengthen the useful life of the tubes. The limit of usefulness will probably not be the burn-out of the filament but rather the limit of earlier turn-on time which is expected to accompany tube decay.

In order to gain some knowledge of this factor, this company is keeping a detailed record of each control installed. Periodically, we expect to field-test a percentage of the installed units and to record these tests. From an analysis of these records, we hope to be able to determine the economic useful life of the tubes. With this information we anticipate setting up a periodic group change of the controls for the replacement of the tubes and readjustment of the control.

Testing of the control has been mentioned quite frequently above. It is our opinion that use of these controls requires a suitable testing means. A high degree of accuracy is not necessary. The light decay curves show that at the one-foot-candle level light intensity is decreasing at the rate of approximately one foot-candle in two minutes. So it is a matter of only a few hours per year whether the control is set at 0.8 or 1.2 ft-c. However, it seems necessary that suitable limits be set to gain reasonable uniformity in the turn-on time. Also it can be said the control is part of the cash register in that it governs the amount of street lighting supplied for the revenue received.

Economics of Electronic Control

Determination of the economics of individual control in comparison with existing means of supplying street light service involves several varying factors. Some existing systems make extensive use of I. L. transformers, others put lamps directly in the series circuit. In some instances systems are designed with two-wire series circuit predominating, while others employ the single wire loop system more largely. These variations and their effects on comparative costs are tabulated in the accompanying table (p 69) of four typical series circuits on our system.

In determination of investment costs for comparison, it is necessary to consider the proportion of distribution system investment used for street lighting purposes. Such apportionment will vary considerably between utilities making analyses. In the tabulated comparison, 28% pole plant and 50% crossarm costs were added for the series circuits. For the individually controlled lamps 28% of the pole plant, 2% of the primary and secondary distribution circuit, and 2% distribution transformer costs were added. The figures show that increased investment for individually controlled multiple luminaires is more than offset by an investment decrease for supply facilities.

Determination of the relative losses for the various methods of supplying street lighting also leads into complications. The series system problems are not too difficult of solution. How-

(*Continued on page 135*)

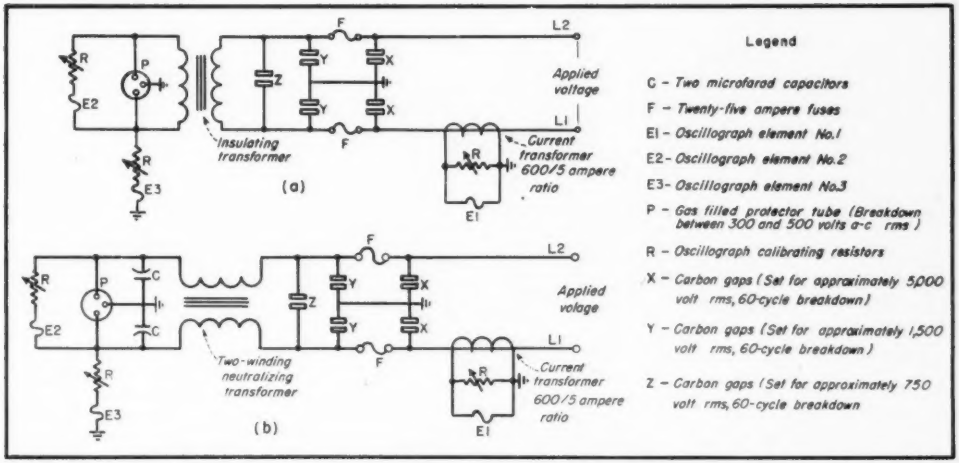

Legend
C – Two microfarad capacitors
F – Twenty-five ampere fuses
E1 – Oscillograph element No.1
E2 – Oscillograph element No.2
E3 – Oscillograph element No.3
P – Gas filled protector tube (Breakdown between 300 and 500 volts a-c rms)
R – Oscillograph calibrating resistors
X – Carbon gaps (Set for approximately 5,000 volt rms, 60-cycle breakdown)
Y – Carbon gaps (Set for approximately 1,500 volt rms, 60-cycle breakdown)
Z – Carbon gaps (Set for approximately 750 volt rms, 60-cycle breakdown
Applied voltage
Insulating transformer
Current transformer 600/5 ampere ratio
(a)
Two-winding neutralizing transformer
(b)

FIG 1—TEST CONNECTIONS for protective scheme used with a-c and d-c signaling circuits shown in (a) and (b) respectively differ only in that an insulating transformer is used for the a-c line and a neutralizing transformer with capacitors for the d-c line

Tests Prove Adequacy of Protection Scheme For Open-wire Signaling Lines

Test data show that terminal equipment on open wire signaling lines can be adequately protected against all possible ways of applying disturbing voltages. Protection scheme for a-c and d-c signaling circuits tested

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and
M. J. BROWN
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Westinghouse Electric Corp
E. Pittsburgh, Pa.

TESTS, in which all possible combinations of voltages that could be applied to a pair of wires, were used to prove that certain combinations of protective equipment will adequately protect open-wire signaling lines for all conditions. These tests show that terminal equipment and personnel can be equally and adequately protected regardless of whether d-c or a-c voltages are used for the transmission of such communication services as supervisory control and telemetering.

Economic considerations often make it desirable to string open-type line wires, used for communications services, on the same poles with power lines. It is often necessary to protect these lines and terminal equipment from the following voltages:

1. Induction from power lines
2. Lightning and other surges
3. Elevation of station ground potential
4. Direct crosses with high voltage lines

Voltages that may be experienced on line wires cannot exceed flashover value of the insulation. Current cannot exceed the ultimate rating of the conductors.

The length of time that possible values of voltage and current can be impressed is determined by several factors: (1) Surges will be of a duration determined by the natural phenomena causing them. (2) Power currents developed by faults will exist until those faults are cleared by the protective equipment on the circuits involved. (3) Ground elevation voltages will exist for the duration of the ground fault causing them and likewise involve the operating time of the protective equipment on the faulted lines. (3) Induction voltages may last for long periods of time if they are produced by coupling with load currents. They may, however, be severe only during a short period of time if caused by fault currents. (4) Voltages due to direct contact with power lines are usually brief also, due to the operation of protective equipment on the power line.

In applying protective equipment to line wires the protection of per-

TABLE I—Test Data Protective Circuit Arrangement Using Insulating Transformer As In Fig 1a

Test No.	Nominal 60 Cycle Volts, Rms Applied	Where Voltage Applied	Current Peak, Amp, Oscillograph Element No. 1	Peak Terminal Volts Oscillograph Element No. 2	Peak Volts One Terminal To Ground Oscillograph Element No. 3	Observations
1a	330	Line-to-line	0	405	194	
1b	330	Line (L2)-to-ground	0	0	0	
1c	330	Two lines-to-ground	0	0	0	
1d	330	Line-to-line with line L2 grounded	0	403	194	
2a	550	Line-to-line	10*	415	219	Protector tube operated
2b	550	Line (L2)-to-ground	0	0	0	
2c	550	Two lines-to-ground	0	0	0	
2d	550	Line-to-line with line L2 grounded	10*	425	210	Protector tube operated
3a	3000	Line-to-line	1030	10*	10*	Both fuses went in 1½ cycles
3b	3000	Line (L2)-to-ground	653	10*	10*	Both fuses went in 1 cycle
3c	3000	Two lines-to-ground	1020	406	219	Both fuses went in ½ cycle
3d	3000	Line-to-line with line L2 grounded	1065	330	275	Both fuses went in 1½ cycles
4a	9000	Line-to-line	500	314	162	Both fuses went and 5 kv gap operated
4b	9000	Line (L2)-to-ground	405	0	0	One fuse operated in 9 cycles and 5 kv gap operated
4c	9000	Two lines-to-ground	300	351	15*	Both fuses went and 5 kv gap operated
4d	9000	Line-to-line with line L2 grounded	550	296	162	Both fuses went and 5 kv gap operated

* Designates that reading was "less than" value given

TABLE II—Test Data For Protective Circuit Arrangement Using Neutralizing Transformer As In Fig 1b

Test No.	Nominal 60 Cycle Volts, Rms Applied	Where Voltage Applied	Current Peak, Amp, Oscillograph Element No. 1	Peak Terminal Volts Oscillograph Element No. 2	Peak Volts One Terminal To Ground Oscillograph Element No. 3	Observations
1a	330	Line-to-line	0	407	356	Protector tube operated
1b	330	Line (L2)-to-ground	0	10*	10*	
1c	330	Two lines-to-ground	0	0	10*	
1d	330	Line-to-line with Line L2 grounded	0	416	198	
2a	550	Line-to-line	10*	388	210	Protector tube operated
2b	550	Line (L2)-to-ground	0	15*	15*	
2c	550	Two lines-to-ground	0	0	15*	
2d	550	Line-to-line with Line L2 grounded	10*	350	190	Protector tube operated
3a	3000	Line-to-line	585	314	162	Both fuses went in ½ cycle
3b	3000	Line (L2)-to-ground	910	...	...	Both fuses went in 1½ cycles
3c	3000	Two lines-to-ground	1200	10*	10*	Both fuses went in 2 cycles
3d	3000	Line-to-line with line L2 grounded	1185	10*	10*	Both fuses went in 1½ cycles
4a	9000	Line-to-line	760	120	65	Both fuses went and 5 kv gap operated
4b	9000	Line (L2)-to-ground	715	10*	10*	One fuse went and 5 kv gap operated
4c	9000	Two lines-to-ground	665	120	57	Both fuses went and 5 kv gap operated
4d	9000	Line-to-line with line L2 grounded	755	37	16	One fuse went and 5 kv gap operated

* Designates that reading was "less than" value given

sonnel and terminal equipment is naturally of paramount importance. However, continuity of service must also be considered. Thus, expendable parts in the protective scheme should only be applied for conditions which warrant a service interruption. Moreover, if it does not entail a sacrifice in the degree of protection, it is desirable to protect against the most probable disturbing voltage conditions by a system which renders the equipment inoperative only during the duration of the fault condition. As the probability of a particular disturbing voltage condition diminishes, the more justifiable it is to accept service interruption and expenditure of equipment.

Tests

Figures 1 (a) and 1 (b) show the arrangement of equipment employed for the tests on the a-c and d-c signaling protective schemes respectively. It will be noted that when a-c signaling is employed an insulating transformer is used to connect the terminal equipment to the line wires. While the use of an insulating transformer eliminates a metallic connection between the line wires and the terminal equipment, it alone will not provide protection against all of the possible ways that a disturbing voltage can be applied. For example, a voltage between line wires would merely be transformed to impress a voltage directly on the terminal equipment.

For d-c signaling a complete metallic circuit between the line wires and terminal equipments must be provided. The test data submitted in this paper were obtained on a protective arrangement for d-c signaling circuits as shown in Fig 1 (b). The two-winding neutralizing transformer shown was introduced in 1935. The two windings of the neutralizing transformer are wound in the same direction on the core so that other than loop currents in the line wires encounter a very high impedance.

It will be noted that the protective equipment employed is duplicated in both circuits except for the use of the neutralizing transformer and the capacitors in the d-c signaling circuit for the insulating transformer in the a-c circuit. The capacitors provide a path to ground for exciting current of the neutralizing transformer to follow.

Test Devices Described

Protective devices employed in the tests are as follows:

1. *Protector tube.* A gas-filled tube with three cold-carbon electrodes. Tube has a breakdown voltage between 300 and 500 v, 60 cycles, rms, between each pair of electrodes. Tube will discharge 50 amp for 2 sec and 7 amp for 10 min.

2. *Gap Between Line Wires on Equipment Side of Fuses.* Carbon gaps with 16-mil air gap. Gap has approximately 750 v, 60 cycle rms breakdown.

3. *Gaps to Ground on Equipment Side of Fuses.* Carbon gaps with 25-mil air gap. Gaps have approximately 1,500 v rms, 60 cycle breakdown.

4. *Gaps to Ground on Line Side of Fuses.* Carbon gaps with 0.10-in. air gaps. Gaps have approximately 5,000-v rms, 60-cycle breakdown. The gaps used will satisfactorily

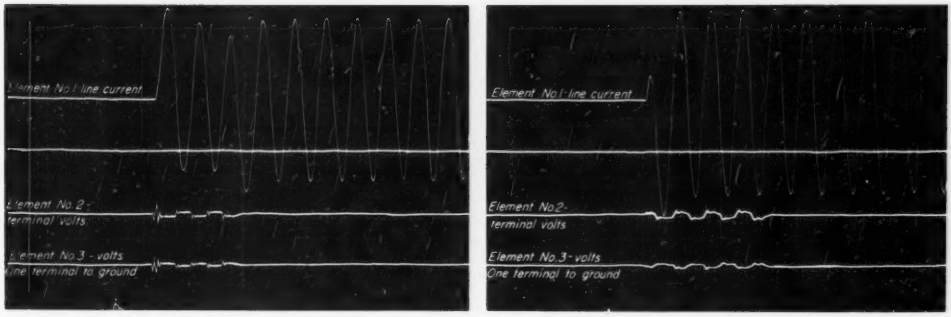

Element No.1-line current
Element No.2-terminal volts
Element No.3-volts one terminal to ground
Element No.1-line current
Element No.2-terminal volts
Element No.3-volts One Terminal to ground

FIG 2—OSCILLOGRAMS obtained when 9,000 v, 60 cycles, is applied between lines with L_2 grounded. First oscillogram is for a-c circuit of Fig 1 (a), second oscillogram is for d-c circuit of Fig 1 (b). Oscillograms correspond to data for test 4 (d) in Tables I and II

carry 5,000 amp rms 60 cycles for five seconds without excessive temperature rise.

5. *Fuses.* 5,000-v fuse cutouts with 25-amp fuse links.

6. *Insulating Transformer.* Insulating transformer used has a one-to-one ratio with the winding good for 0.25 amp continuously. The primary or line winding is insulated from the secondary and from ground for 30,000 v, 60 cycles. The secondary or equipment winding is insulated from ground for 2,500 v, 60 cycles. With a secondary load of 500 ohms the transformer has approximately a one-decibel loss at 500 cycles and an 8-decibel loss at 4,000 cycles.

7. *Neutralizing Transformer* used in d-c signaling circuits presents low-resistance to the signal impulses and very high impedance to the surges of foreign currents. The 60-cycle and impulse voltage ratings are these: Between terminals of same winding, 4,000 v, 60 cycles and 15,000 v impulse; between adjacent terminals of different windings, 3,500 v, 60-cycles and 6,000 v, impulse; between either winding and frame, 10,000 v 60 cycles. Windings are good for 0.3 amp continuous and 20 amp for one second. Each winding has a resistance of 95 ohms and each winding alone or both windings in parallel have a 60-cycle impedance of over 40,000 ohms.

8. *Exciting Capacitors.* Small, two-microfarad Inerteen capacitors with a 600-v, d-c rating.

Disregarding the origin of the disturbing voltage, there are only certain possible combinations that can be applied to a pair of wires. These are as follows:

1. Voltage applied line-to-line.

2. Voltage applied one-line-to-ground.

3. Voltage applied other-line-to-ground.

4. Two line wires connected together and voltage applied between ground and both lines.

5. One line wire grounded and voltage applied line-to-line.

6. Other line grounded and voltage applied line-to-line.

While some of the conditions listed above are much less likely to occur than others, a protective scheme must be adequate for all conditions that may be met.

Test Voltages Applied

For the tests, four different values of 60 cycle voltage were applied to the protective equipment in the ways necessary to check all of the possible disturbing voltage applications. The lowest test voltage applied was 330 v, 60 cycles. This value is too low for operation of any of the protective gaps. The second value used was 550 v, 60 cycles, this voltage being above the breakdown rating of the protector tube. The third value of 3,000 v, 60 cycles is above the breakdown of gaps on the equipment side of the fuses. The fourth value of 9,000 v, 60 cycles is above the breakdown of the gaps on the line side of the fuses. Voltages higher than 9,000 v would result in the same action as resulted in the 9,000-v tests. Thus, the tests covered the complete range of possible 60-cycle disturbing voltages. Since the breakdown lag of insulation is greater than the breakdown lag of carbon gaps, voltage surges will be adequately protected against if sufficient protection is provided for 60-cycle voltage.

Test Data

The peak terminal volts line-to-line and line-to-ground, as well as the line current values given in the charts are as read from the oscillograph pictures. Fig 2 (a) is the oscillogram for test 4 (d) of Table I and Fig 2 (b) is the oscillogram for test 4 (d) of Table 2.

With both the neutralizing transformer and the insulating transformer arrangement, the only expendable item need be the line fuses.

With the proper use of current limiting resistors in the line circuit it is usually possible to have only a fuse blow in the event of direct contact with a high tension line. Since continuity of service is of prime importance it is desirable to prevent opening the line circuit by the blowing of a fuse where possible. If the gaps shown in Figs 1 (a) and 1 (b) on the equipment side of the fuses have sufficient current-carrying capacity to have a continuous current-carrying rating above the maximum current which could be encountered for any disturbing voltage condition, the fuses and the gaps on the line side of the fuses need not necessarily be used.

If both d-c and a-c signaling are employed on the same pair of wires, both an insulating transformer and neutralizing transformer can be applied at each terminal. Gaps and fuses can be common to both circuits.

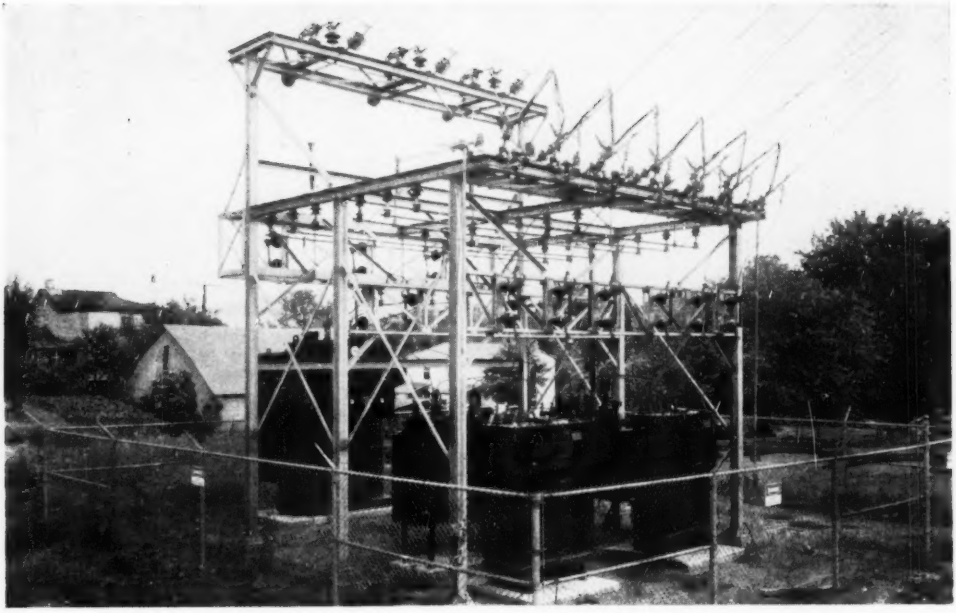


FIG 1—TYPICAL 3,750-kva, 13.2-2.4/4.16-kv Y standard steel installation. Incoming 13.2-kv pull-off over low-voltage structure

Pros and Cons of Substations

UNIT TYPE AND CONVENTIONAL

Advantages and disadvantages compiled from actual experience with recent installations. Troubles attributed to methods of installation and other factors

FREDERICK J. ZAK
Supervisor Substation Engineering
Virginia Electric & Power Co

THIS COMPARISON will cover only two specific sizes of unit substations, 1,500 kva and 3,000 kva, each rated 11 kv or 13.2 kv on the high voltage side and 2.4/4.16 kv wye on the low voltage side, and the corresponding conventional steel structure types. The 1,500-kva size has one 2.4/4.16-kv wye low voltage circuit, while the 3,000-kva size has two low voltage circuits. Neither of the unit type substations nor the 1,500 kva conventional type has a transfer bus or by-pass facilities. The unit type substations have bus regulation, while the conventional types have individual feeder regulators. For this comparison the above differences will be overlooked, although the inherent benefits are not only quite essential but also important as well, when it is studied from the operating point of view.

The salient advantages of the unit type substation, based upon our experience, may be listed as follows:

1. Less Substation Yard Required

The unit type substation required about ⅓ less physical ground space and less head room than the conventional type. Less grading was necessary and, conservatively, about ⅓ less crushed rock was required. Less space means less yard maintenance.

2. Less Concrete Slab Work

Although the single slab installations made required about 10 cu yd of concrete, which was the same amount as for all the slabs for the conventional type, the slab for the unit type required one job of forming, whereas the slabs for the conventional type required about 12 separate forms.

3. More Suitable in Restricted Places

The unit substation is more suitable for installation in restricted resi-

Adapted from paper at recent meeting of Southeastern Electric Exchange, Engineering and Operation Section.

dential locations where it is necessary to comply with building and zoning restrictions. In another instance, it was decided to replace the present conventional type of substation with a unit type of increased capacity since it requires less square-foot space.

4. Less Handling and Connections Made Quicker

Since the 3,000-kva unit type comprises only two parts, the transformer and the switchgear, and the 1,500-kva unit is in one or two parts, the number of parts handled is considerably reduced, and also less time is required to make the necessary high voltage and low voltage connections.

5. Greater Mobility

Use of the unit type substation results in greater mobility since the 3,000-kva units comprise but two parts and the 1,500-kva, one or two. Up to the present time we, and perhaps other companies, have not been able to take advantage of this benefit, because deliveries have taken so long and we have not had enough of them on hand. We have on hand and in service four 1,500-kva, three 3,500-kva and five 3,000-kva unit type substations. We have, however, on order eight 1,500-kva, one 2,500-kva and six 3,000-kva units.

Disadvantages of Unit Substations

Some of the disadvantages of the unit type substation listed below would be either minimized or even eliminated if a portable substation were available for use. We do not have a portable on hand, but we have one on order. The outstanding disadvantages of the unit type substation, which we have encountered under our conditions and which we consider important, are listed as follows:

1. Normal Inherent Design Not Flexible—Normal design prevents uninterrupted service from a unit substation when the tap-changing-under-load mechanism develops trouble or needs general maintenance. It is not possible to by-pass this and so maintain unregulated service. The entire unit must be taken out of service. Although not so commonly encountered, failure of either transformer or switchgear section would require removal of these sections from service during repairs. Section terminal is also necessitated when conditions indicate that maintenance of either section is in order.

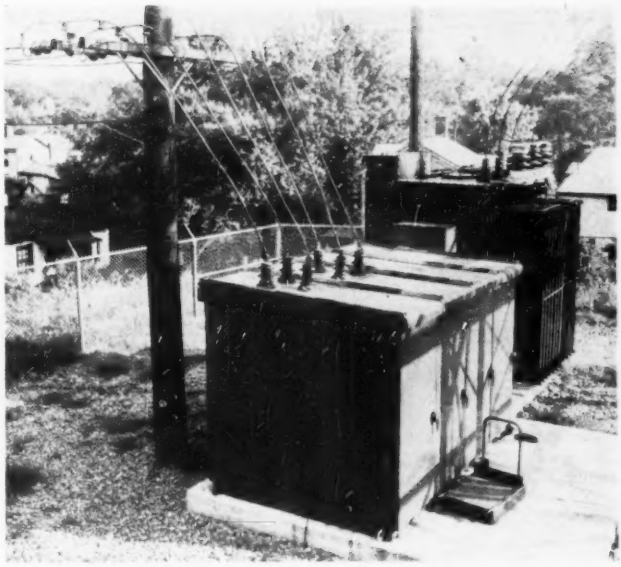


FIG 2—OVERHEAD connections to typical 3,000-kva 13.2-2.4/4.16-kv Y unit sub-station. Two low-voltage circuits are connected to metal enclosure in foreground

2. No By-pass and Transfer Bus Facilities for Switchgear Breakers—The standard design does not include the by-pass and transfer bus facilities for the breakers in the switchgear section. Therefore, in order to do any maintenance work on the breaker, it is necessary either (1) to interrupt service to replace the breaker with a spare one, (2) to provide pole-top feeder cut-over facilities outside the substation, or (3) provide means to tie the distribution circuits together so adjacent substations will carry the load until the breaker is checked and repaired. We have been resorting to the last method of carrying the load from other substations for conditions of this nature. We have not purchased spare breakers, since the unit substations in the different localities are purchased from more than one manufacturer, and spare breakers would not be interchangeable. If a portable substation were available, this disadvantage would not be so critical.

3. Replacement Parts of Major Items—Due to the inherent design, it is impractical to carry in stock replacement parts covering the major items such as the tap-changer or major sections of the bus. The time element required to make the replacement of these parts, even if that particular item should be on hand, would amount to more than that required to make a repair of the part involved. This disadvantage would also be alleviated if a portable unit were available for us.

4. Not Suitable for Isolated Locations—The unit type substation does not lend itself to locations at the end of long radial supply feeders, or to those remote from other substations. We had a case of this nature under consideration in which a community, about 10 miles away and served by a 13.2-kv feeder, required an increase in substation capacity. The substation space was limited, and the unit type would have been ideal insofar as this location was concerned. However, since the nearest relay source or substation was about 10 miles away, the unit type substation idea was abandoned. If the unit type installation had been made at this location and any trouble occurred, all service to the community would have had to be cut off, at best, until the nearest substation service man (in this case, 10 miles away) could arrive and possibly restore service.

5. Concrete Foundations More

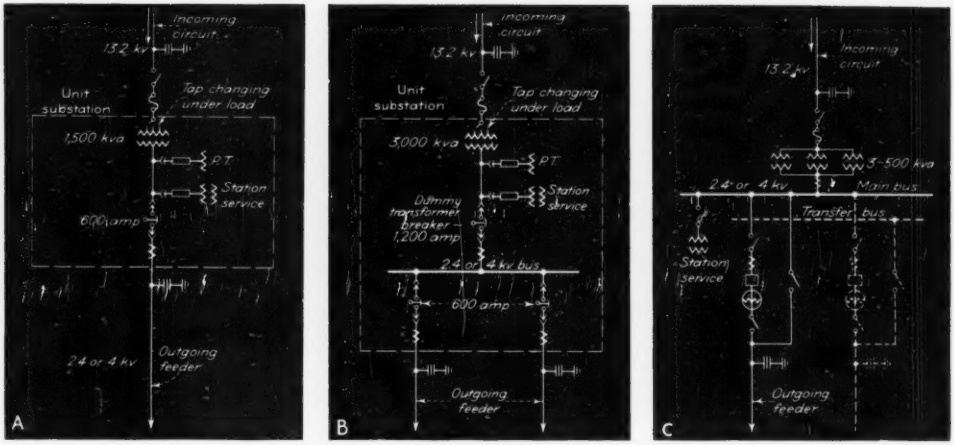


FIG 3—ONE-LINE DIAGRAMS, for typical substations: unit type (A) 1,500 kva with bus regulation, (B) 3,000 kva; conventional steel structure type, (C) 1,500 kva, (D) 3,000 kva. Both of the conventional types can be designed to include a transfer bus. Outgoing feeders

Critical—Even though, as listed in "Advantages", paragraph **"2"** above, less concrete slab or foundation work is necessary for the unit type substation, we have found that, particularly for the 3,000-kva size, which requires a reinforced concrete mat approximately 20 ft long and 17 ft wide, it is necessary to have the top perfectly level underneath the equipment and not merely approximately level. In our first installation, the top of the slab was only approximately level, and it was necessary to use four ¾-in. washers at one end and a lesser number in between in order to align the switchgear section and the transformer.

6. Not Feasible for Small Temporary Substation Installation—The question comes to our minds—how small is small, especially when temporary substations are considered? In this case, reference is made to transformer capacities of 600 or 1,000 kva serving one outgoing low voltage circuit, preferably without a breaker, and generally without voltage regulators. As far as investment is concerned, if a 1500-kva unit type substation were used for this purpose, the ratio of cost would be conservatively about 4 or 5 to 1, and impractical to consider for installation.

7. Manufacturers Not Furnishing Proper Component Parts of Unit Substation In One Shipment—In this connection, perhaps our experience has been rather unusual, but, at any rate, we have encountered this problem more than once. In one instance, a 3,000-kva unit substation was installed, and it was found that the gas was leaking, a bushing was broken, transformer tank was bulged out by gas pressure, the shaft of the tap-changing-under-load mechanism was bent and could not be operated. About 6 to 8 weeks time elapsed before this was repaired and the unit placed in service.

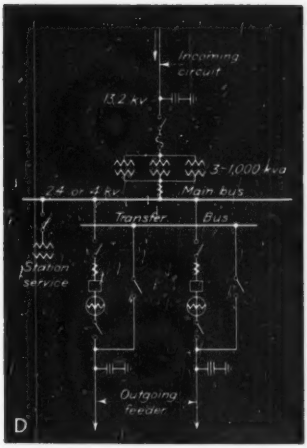
Then another 3,000-kva installation was to be made and the manufacturer shipped the switchgear in October, but the transformer was not received until April of the next year. In another 3,000-kva installation, the manufacturer shipped the transformer in April and the switchgear section in June. Then, when this particular unit was being assembled, the switchgear section would not fit to the transformer. The radiators were welded in the wrong places on the transformer unit and special extension plates had to be provided for the throat connecting the transformer and switchgear, and, also the bus connection had to be extended.

In another case, a 3,000-kva unit was ordered for either 2,400 or 4,160-v wye operation on the low voltage side. The equipment, when received, was for 4,160-v wye service only, having single bushing potential transformers and other such equipment. This resulted in several weeks delay in order to make all the necessary connections and replacements so that this unit could be connected for 2,400-v delta service. The equipment should be assembled and checked before shipment is made, to prevent conditions of this nature.

8. Bus Regulation Limitations—Many studies have been made and considerable thought has been directed toward the merits of bus regulation vs individual feeder regulation. We are experiencing a condition, at the present time, at one of the 3,000-kva unit installations where bus regulation is not adequate due to one circuit being short, serving considerable commercial load, while the other circuit is rather long, serving residential load altogether. Conditions like this, undoubtedly, are local problems and are special cases which have to be worked out. Nevertheless, they require special engineering and, all in all, contribute to the limitations of a unit type installation.

Conventional Structure Substations

The steel structure substation which we have developed and adopted as our so-called "standard" substation consists of a rather simple steel structure weighing about 5½ tons which can be erected on the foundation in 8 hr by a crew of one foreman and five men. This structure is suitable for the installation of 5,000-kva maximum



on steel structure types are equipped with individual breakers and voltage regulators

transformer capacity, either single phase or 3-phase units with a spare. It is also suitable for 44, 33, 22 or 13.2 kv on the high voltage side, and 7.6/13.2 Y or 2.4/4.16 kv Y on the low voltage side. Furthermore, it is designed so that the high voltage feeder may enter from the side opposite to the pull-off of the low voltage circuits or from the same side. This structure provides initially two 10-ft low voltage feeder bays, which can accommodate a main and transfer bus, and also ample space for a feeder breaker and regulators, either single phase or 3-phase. When additional feeders are required, bays can be added to either end, each of which may provide space for two outgoing feeders. The effective ground space, required by this substation, for two outgoing low voltage feeders is about 20 x 30 ft.

Advantages and Disadvantages

Although it will not be attempted to match each specific disadvantage of the unit type substation with an advantage of the conventional type or vice-versa, the following listed advantages and disadvantages are based upon the same conditions, and also upon other practical operating conditions:

1. Flexibility—When single-phase transformers are used and one unit develops trouble, it can readily be disconnected. The spare can be connected to replace it, or the remaining two units can be left to carry the load, if not too excessive. If the transformers of greater capacity are needed, the replacement can readily be made. If a breaker or regulator, or both, need to be taken out of service for repairs, maintenance or replacement with larger ones, they can be switched out on the transfer bus and may be worked on or replaced during a light load period without any external switching or interruption of service.

2. Ease of Equipment Handling—In the conventional steel-structure type of substation, the power transformers and regulators may be single or three-phase. If the equipment is single-phase, there naturally are more pieces of equipment to handle, the heaviest item being the transformer, a 1,000-kva 13.2-2.4/4.16-kv wye, which weighs about 10,000 lb. If the regulator is a 3-phase 180-kva 2.4/4.16-kv wye unit, it will weigh about 9,000 lb. A 3-phase 3,000-kva 13.2-2.4/4.16-kv wye transformer, however, weighs about 30,000 lb and would require more careful and special handling and moving facilities. With respect to moving and handling, the 1,500-kva and 3,000-kva unit substations fall into the same category as the above 3-phase 3,000-kva transformer, since the total weight of the 1,500-kva unit type substation is about 39,000 lb. The 3,000-kva unit substation transformer section weighs anywhere from 34,000 to 54,000 lb, and the switchgear section about 15,000 lb.

3. Operating and Maintenance Benefits—The chief operating and maintenance advantages, derived from the use of single-phase or 3-phase conventional equipment, are due to familiarity with and more common knowledge of the various items gained from past experience. The operation and maintenance of the unit type substation, however, requires study and very thorough knowledge of the co-ordinated and combined parts of the unit, and generally requires a sub-station man specially trained to operate this equipment.

The preceding discussion indicates a leaning toward the conventional type. However, the unit type is not being condemned at all. It definitely has inherent advantages needed for specific installations, and, for this reason, we have additional units on order. In order to overcome some of the operating disadvantages of the unit type, we consider it most desirable to have one or more portable type substations to use in conjunction with the unit type.

Conclusions

Basically, we like the idea of being able to relieve our load in an area by picking up an integral unit or package, and connecting it to the same or a nearby feeder, without any considerable amount of time, space and labor involved. Still, it must be admitted that the conventional steel structure substation offers very keen competition to the unit type. The various component parts of the conventional substation, such as strain insulators, clamps and etc, for strain buses, are normal stock items on hand and are used practically daily in line and other work. Also, since breakers and the single and three phase regulators and transformers are continually being replaced with larger ones, the re-use of this equipment must be considered and results ultimately in a form of competition. Furthermore, we all know that several manufacturers have available and can offer standardized steel structure substations which are very simple and satisfactory.

Further Considerations

Worthy of further study and consideration are these suggestions:

1. That breakers of different manufacturers be interchangeable. Also that one manufacturer's transformer unit would be interchangeable with that of another insofar as connections are concerned to the switchgear section.

2. That the tap-changing underload equipment be made a separate detachable part which can be bypassed and readily replaced with another one, and that these tap changer units of various makes be interchangeable.

3. That the manufacturers make the transformer and breaker sections at the same place or have the integral sections assembled and tested together before they are shipped.

4. That the cost of the equipment be lowered to make it easier to justify its use and installation.

DISTRIBUTION CIRCUIT RATING REPORT

Station Wilkinsburg Date Feb 1

Circuit No. 4107

JULY NORMAL RATING 308 Amps. Limited by Station Fire

DEC. NORMAL RATING 349 Amps. Limited by Relay C. T.

Please place red arrows on the circuit ammeters to indicate the July and December current rating.

(Signed)

Inventory of bank circuit equipment Required [X] Not Required [ ] (Fill in blanks)

	Bus Disc.	OCB	Relay C.T.	Reactor	Rec. Cut.	Line Disc.	Fuse	Ammeter	Recorders
HP Amps	600	600	200/5	700	700/5	600	6/0	300/5	700
HP Volts	4 kv	15 kv	8 kv	4 kv	8 kv	4 kv	5 kv	-	2.4 kv
Make	Westi.	Westi.	Westi.	Westi.	Westi.	Westi.	-	Westi.	Westi.
Type	S	F-100	64	CL	50	S	YCHF	FT-41	C
VA Rating	-	-	50	12.6 kva	50	-	-	-	46 kva
Location Code	3	3	3	3	3	3	3	3	3

Location Code: 1- Outdoors exposed or in ventilated compartment.
2- Outdoors in closed compartment.
3- Indoors exposed or in ventilated compartment.
4- Indoors in closed compartment.
5- In oil-filled equipment.

Ventilating System if equipment is indoors: (Please note name plate data of ventilating fans) Regulator room and 3 intake louvres 12" x 36" in outside wall at floor level and 1- 1/4 hp. 4a". 850 rpm. 4/c propeller fans in roof ventilators.

Fan thermostat set at 70°F.

Copies to: Operating Div. (to be returned) Check by
Operating Div. (to be retained)
System Operator
Planning Division
Date 2-25-41

FIG 1—**CIRCUIT RATING REPORT** used in issuing approximate (Step 1) equipment ratings. Data based on nameplate ratings, to which ambient temperature adjustments were applied, guide placement of markers on instruments to show winter and summer limits

FIG 2—**RED ARROW MARKERS** on substation instruments indicate summer and winter thermal rating of the circuit. Winter loads in excess of upper arrow and summer loads above lower arrow are reported on overload report. Serious overloads are reported immediately

Thermal Ratings for Feeder Equipment

Three step method of rating substation feeder equipment based on careful determination of thermal capability of apparatus. Resulting increase in distribution circuit loading brings substantial savings in carrying charges

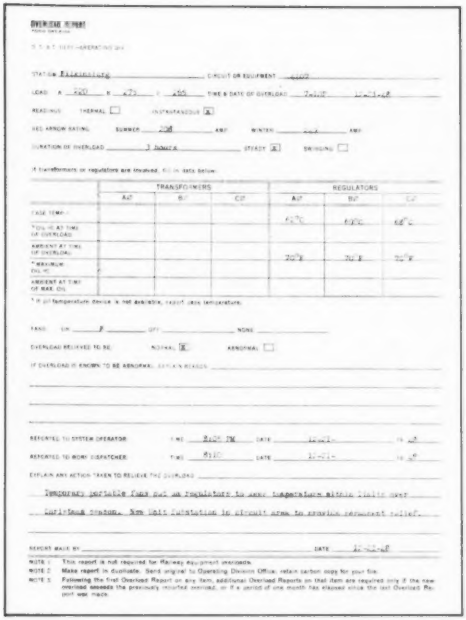
ALBERT F. PHILLIPS
Investigating Engineer
Duquesne Light Co
Pittsburgh

CONSIDERABLE INCREASE in loading can safely be carried on substation feeder equipment, with little increase in operating expense and vast savings in carrying charges, by applying safe thermal ratings and then instituting a follow-up system set up to insure that the ratings are not exceeded.

Such a method of rating, which used station operators and traveling operators as key men in the follow-up system, has been applied successfully on the Duquesne Light Co system for almost a decade with no increase in the failure rate due either directly or indirectly to overloads. The method has been applied to about 250 regulated circuits, 45% of which have major equipment over 25 years old, and 58% using equipment which is over 20 years old.

At the time this work was started, it was found that 75% of all distribution circuits were limited in rating by associated substation feeder equipment. Initiated as a wartime measure, the savings resulting from utilizing equipment to its safe thermal limits dictated continuation of the practice, even today, wherever voltage regulation was satisfactory.

The exact procedure of rating equipment and fixing operating tem-



OVERLOAD REPORT

STATION Kittanning CIRCUIT OR EQUIPMENT 4107

LOAD A 420 B 273 C 255 TIME & DATE OF OVERLOAD 7 a.m. 7-14-49

READING: THERMAL ☐ INSTANTANEOUS ☒

SEE ARROW RATING: SUMMER 408 AMP. WINTER 442 AMP.

DURATION OF OVERLOAD 3 hours PEAK ☒ SWINGING ☐

If transformers or regulators are involved, fill in data below.

	TRANSFORMERS			REGULATORS		
	A-Ø	B-Ø	C-Ø	A-Ø	B-Ø	C-Ø
CASE TEMP.				62°C	63°C	68°
°C RISE AT TIME OF OVERLOAD						
AMBIENT AT TIME OF OVERLOAD						
*MAXIMUM OIL °C				70°F	70°F	70°F
AMBIENT AT TIME OF MAX. OIL						

* If pit temperature device is not available, report skin temperature.

TAKEN: ON ☐ OFF ☐ NONE ☐

OVERLOAD RELIEVED TO BE: NORMAL ☒ ABNORMAL ☐

IF OVERLOAD IS KNOWN TO BE ABNORMAL, EXPLAIN REASON:

REPORTED TO SYSTEM OPERATOR TIME 8:20 PM DATE 7-14-49 BY JP

REPORTED TO WORK DISPATCHER TIME 8:40 DATE 7-14-49 BY JP

EXPLAIN ANY ACTION TAKEN TO RELIEVE THE OVERLOAD

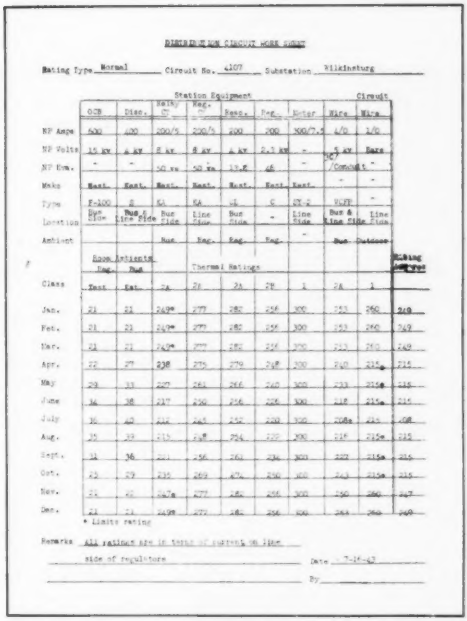
Temporary portable fans put on regulators to keep temperatures within limits over

Carrithers Station. New unit substation in circuit area to provide permanent relief.

REPORT MADE BY DATE 7-14-49

NOTE 1: This report is not required for Railway equipment overloads.
NOTE 2: Make report in duplicate. Send original to Operating Division Office; retain carbon copy for your file.
NOTE 3: Following the first Overload Report on any item, additional Overload Reports on that item are required only if the new overload exceeds the previously reported overload, or if a period of one month has elapsed since the last Overload Report was made.

FIG 3—OVERLOAD REPORT used by substation operators in reporting loads above the thermal ratings of the circuit. Such loads are reported whether they are normal recurring loads or temporary emergency loads. A station peak load report is also prepared monthly



DISTRIBUTION CIRCUIT WORK SHEET

Rating Type Normal Circuit No. 4107 Substation Kittanning

	Station Equipment							Circuit	
	OCB	Disc.	Rate/ Reg.	Reg.	Bkrs.	Reg.	Inter	Wire	Wire
NP Amps	630	400	200/5	250/5	400	200	300/5	4/0	1/0
NP Volts	15 kv	4 kv	8 kv	8 kv	4 kv	2.3 kv	-	5 kv	Bare
NP Kva.	-	-	50 kv	50 kv	13.8	46	-	4107 Combined	-
Make	Kest.	Kest.	Kest.	Kest.	Kest.	Kest.	Kest.	-	-
Type	F-100	S	5A	6A	4L	C	CY-2	VUT	-
Location	Bus Side	Bus & Line Side	Bus Side	Line Side	Bus Side	-	Line Side	Bus & Line Side	Line Side
Ambient			Bus	Reg.	Reg.	Reg.	-	Bus	Outdoor

	Room Ambients		Thermal Ratings						Rating Amps Per
	Reg.	Bus							
Class	Test	Est.	2A	2A	2A	2A	1	2A	1
Jan.	21	23	249*	277	282	256	300	253	260	249
Feb.	21	23	249*	277	282	256	300	253	260	249
Mar.	22	23	249*	277	282	256	300	253	260	249
Apr.	22	27	238	275	279	248	300	240	255	215
May	29	33	207	261	266	240	300	233	215a	215
June	36	38	227	250	256	226	300	218	215a	215
July	36	40	222	245	252	220	300	208a	215	208
Aug.	35	39	215	248	254	222	300	214	215a	215
Sept.	33	36	221	256	261	234	300	222	215a	215
Oct.	25	29	235	269	274	236	300	243	215a	215
Nov.	24	26	247a	277	282	256	300	250	260	247
Dec.	21	23	249*	277	282	256	300	253	260	249

* Limits rating

Remarks All ratings are in terms of current in line side of regulators

Date 7-14-49

By

FIG 4—CIRCUIT WORK SHEET used for summarizing equipment ratings which have resulted from a more accurate (Step 2) determination of capability based on tests or manufacturer's data. Equipment ambient operating temperature is considered in assigning these ratings

Boost Circuit Loading, Defer Investment

perature limits for various types of equipment have been adequately discussed in previous technical articles. Moreover temperature limits for normal and emergency operation are usually a matter of company policy. For these reasons the emphasis in the following discussion will be placed on methods rather than rating limits.

The rating task that faces a utility having some 250 regulated circuits embracing over 5,000 individual items of substation distribution feeder equipment is not a small one. All this equipment must be rated thermally before the composite capacity of circuits can be obtained.

Three Rating Steps

To provide accurate ratings only where necessary, a three step method of rating has been used on the Duquesne Light System.

Step I—Where the load did not justify accurate determinations only approximate ratings have been assigned, based on nameplate amperes with ambient temperature adjustments. Methods used were similar to those in ASA Transformer Guides (C57). Because such ratings were based on construction prints and meager inventory data, they were issued on forms of the type illustrated (Fig 1). Operators installed red-arrow markers on meter scales to show summer and winter rating limits. The inventory of circuit equipment is checked at the same time, thus verifying equipment lists and providing a basis for future rating studies.

To provide a follow-up system that the operator could use in furnishing information on overloads, the report form shown (Fig 3) has been used. This "overload report" is filled out and sent to headquarters whenever loads exceed limits set on the meter. Serious overloads are reported to the system operator immediately and subsequently followed up with a written report. All loads in excess of limits are reported, whether they are normally recurring loads or temporary emergency loads. The load classification is noted on the report. In addition, the station operator prepares a monthly peak load report of the circuit loading in the station. Only normal circuit loads are reported. Abnormal conditions are deleted. These normal load conditions are compared with monthly thermal ratings for the circuits.

Step II—If loads exceed 90% of rating an accurate appraisal of circuit capacity is undertaken, involving capabilities of individual pieces of

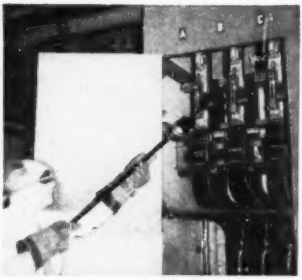


FIG 5—MEASURING TEMPERATURE of a disconnect switch under load during peak load period using thermocouple and high resistance millivoltmeter, calibrated in terms of temperature rise, is one of steps (Step 3) in determining circuit thermal capabilities

equipment in the circuit. This includes, feeder voltage regulators, oil circuit breakers, reactors, current transformers, disconnecting switches, station wire, etc. If data on certain equipment are not available, laboratory tests on similar equipment, or manufacturer's data, are used in calculating more accurate ratings, which are summarized on the "circuit work sheet" form (Fig 4). In assigning these ratings, ambient operating temperature of the equipment is considered. In the case of indoor operating equipment, for example, aisle temperatures, plus an allowance for compartment temperature rises are taken into account.

Supervision Necessary

Closer supervision of the equipment operating conditions is usually required after these higher Step 2 ratings have been assigned. For instance, neutralization number and interfacial tension value of oil in regulators is checked. The accuracy of metering and instrumentation should be improved when fluctuating loads such as those caused by welders, electric furnaces or large motors are prevalent. Thermal-type meters have been found more satisfactory for measuring loads of this type. Their location is most important for if the metering current transformer is in the circuit ahead of the regulator, currents registered during peak load period may be 10% higher than actual circuit loading due to the ratio of transformation on the feeder voltage regulator.

When necessary calculations and minor improvements have been completed, field instructions on the operation of ventilating equipment, etc are issued, ratings revised, and all interested parties, including operating, planning and related organizations notified. The class of the rating is given so that the degree of conservatism in the rating is understood.

Step III—As the load approaches 90% of the Step 2 rating, still further investigations are made into the thermal capability of equipment. Load cycle ratings are calculated, taking advantage of the thermal time constant of regulators, circuit breakers or other limiting equipment. Where minor "bottlenecks" are present, in station wire or current transformers, they are replaced where economically justified. On new circuits the equipment is usually matched thermally, but in many of the older installations, this is not always true.

In assigning Step 3 ratings, studies are usually made of the regulator room and compartment ventilation and their operating temperatures. The importance of good ventilation cannot be over estimated. An increase in temperature of approximately four or five degrees Centigrade decrease the life of class "A" insulation to about half. Where high loads are experienced, it is desirable and necessary, in many cases, to install thermostats to automatically control ventilating fans and so maintain satisfactory ambient temperatures. It may be necessary to improve the ventilation of reactor compartments by screening them, and to reduce truck type circuit breaker temperatures by providing natural ventilation through the breaker and truck contact compartments.

Where there is a question about the operating temperature of disconnecting switches, a field temperature survey is made during the peak load period. A thermocouple, combined with a high resistance millivoltmeter, calibrated in terms of temperature rise, is used for this purpose, as shown (Fig 5). Where high temperatures are experienced, the switches are silverplated or the jaws rebuilt with silver buttons to lower and maintain a low contact resistance.

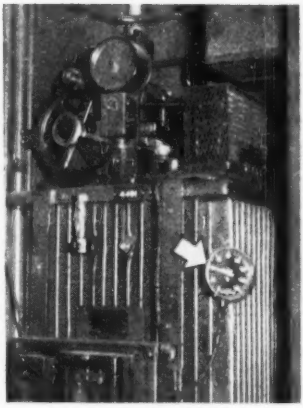


FIG 6—OIL THERMOMETER installed on older-type induction regulator to permit supervision of temperature. Alarm contacts are set for 80 C and used to detect abnormal loading in some attended and many unattended, remote indication equipped substations

Where high thermal ratings are assigned to regulators, temperature as well as current is supervised and used for follow-up. New regulators are equipped with oil thermometers and all old regulators, when they pass through the shop for reconditioning, are so equipped (Fig 6). These thermometers have alarm contacts, maximum temperature hands and wells. Alarm contacts are usually set for 80 C and used for detecting abnormal loading in some attended stations as well as in many automatic stations where remote indication equipment is installed. The maximum hands are read weekly and maximum monthly temperatures are recorded as a follow-up check of the operating condition. Since the thermometers are installed in wells they can be removed periodically and calibration verified.

Data is also furnished to operators on the permissible oil temperature and case temperature of regulators not equipped with thermometers for various percent loads. With this information the operator can read the load and the case or oil temperature, and determine whether the permissible hottest spot temperature is being exceeded during normal overloads or

infrequent emergencies. Allowable temperature limits for both normal and emergency are furnished.

If permissible regulator temperature is exceeded, because of abnormal load growth, long material deliveries, unforseen emergencies, etc, temporary fans are installed to reduce the operating temperature until the condition can be permanently corrected. By using fans only as a reserve for these contingencies, rating considerably above nameplate values can be assigned without endangering the equipment, even under such unforeseen conditions as extremely rapid load growth.

With high circuit loading the voltage problem may become more acute. In order to improve this condition, two factors are important: (1) Station voltage level, and (2) control band width. Circuit regulation is of course important, but any correction of this condition may be made outside of the substation. The station voltage level should be adjusted so that the maximum buck and maximum boost on any regulator connected to the bus are approximately equal. A number of regulators are equipped with maximum and minimum hands on the position indicator so that ranges can be determined without difficulty.

Reduction of the band width so that greater regulation can be permitted is a more difficult problem. However, by adding time delay and by modernizing the older type regulator with slow speed gear motors and improved control, the band width can be reduced to a much smaller value. If the band width can be reduced from $\pm 1\frac{1}{2}$ v to $\pm \frac{1}{2}$ v, two more volts are made available for circuit regulation. Thus, if the feeder was originally designed for a 10-v drop, a 2-v reduction in band width will permit 20% more load with the same regulation.

Another important factor to consider when overloading induction regulators, is the high torque produced when the regulator is in a mid-position between neutral and the maximum position. This torque may be unobjectionable during emergency conditions if it is in such a direction as to cause it to revolve toward the maximum boost position where it can be blocked. The extreme vibration and high torque are not usually experienced at loads below 160 or 170% of nameplate value.

Success of the methods described in this article was largely due to a knowledge of equipment capabilities gained by the operators through a training program and complete field instructions.

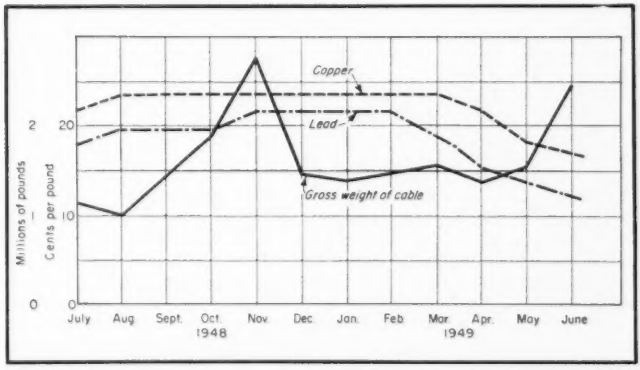
Since postponing new installations for only a year results in a saving of about 10% of the investment cost of the new equipment, it is essential that every effort be made to utilize older equipment to its safe thermal and satisfactory voltage limits.

Substantial Revenue From Scrap Conductors

DAVID WILLIAMS
Manager
Electrical Equipment & Cable Purchases
Consolidated Edison Co of New York, Inc

AN INCREASE in cash returns has been realized by the timely disposal of cable in the scrap classification. Replacement of smaller cable by larger to handle increasing loads creates a considerable surplus of scrap beyond that which is reclaimed for reuse.

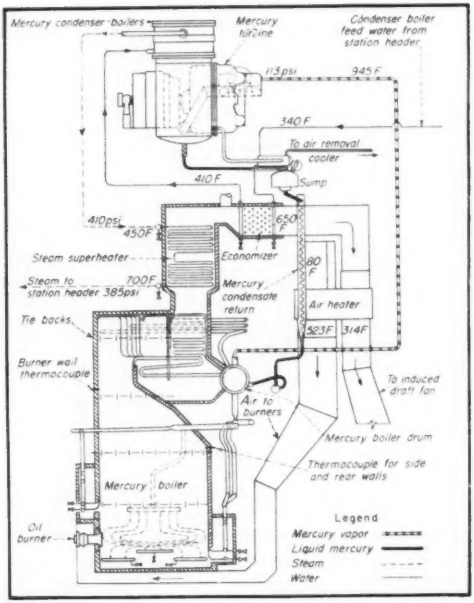
To help alleviate a critical shortage of copper and lead, and to determine what cables could be profitably unearthed while unusually high prices prevailed for those metals, an economic study was made in 1948. Then an accelerated program of cable removal was initiated, with the result that $2\frac{1}{2}$ times as much scrap cable was sold between June 30, 1948, and June 30, 1949, as was sold in either of the preceding two years. Cash receipts during this same period were three times that of each of the preceding years, as shown in the following tabulation.



MONTHLY SCRAP cable disposals reached a peak when metal prices were unusually high

Volume of Scrap Cable Disposals

Year	Wt of copper (lb)	Wt of lead (lb)	Cash Receipts
1946–7	3,283,000	3,756,000	$936,000
1947–8	2,838,000	2,939,000	922,000
1948–9	7,317,000	8,538,000	2,760,000



SCHEMATIC LAYOUT of 15,000-kw mercury boiler and turbo-generator at Hartford, utilizing steam at a pressure of 410 psig

Operating Results of Latest Mercury Boiler Topping Unit at Hartford

Number of days covered	28
Date operation began	Feb. 1, 1949
Total kwhr output of unit including steam	21,435,000
Kwhr gross output from mercury-driven generator	10,048,000
Kwhr generated by mercury condenser boiler unit, equivalent electrical energy	11,387,000
Kwhr consumed in auxiliary equipment	565,000
Kwhr total net output	20,870,000
Pounds of fuel oil burned in mercury boiler	12,281,169
Pounds of steam generated at 260 psig and 700 FTT	126,118,000
Fuel rate in pounds of oil per net kwhr	0.588
Heat rate in Btu per net kwhr	10,200

NOTE: All quantities shown are actual net figures. All charges have been made to the mercury plant occurring from associated auxiliary equipment, whether it is a part of the mercury plant directly or a part of the steam turbine unit using steam from the condenser boilers. The shutdown of the unit at the end of 28 days was due to a partial stoppage in the regenerative air heater. Thorough inspection of the unit during this shutdown indicated that all parts of the mercury cycle were in as good condition as at the time of start-up. From the Hartford company's experience to date no serious difficulty is anticipated with any part of the equipment covered by the new design. The plant forces are adequate to handle all phases of the new problems introduced by the necessary chemical treatment, the special metals used in fabrication and the instrumentation. Hartford's original 10,000 kw mercury topping plant was constructed for commercial energy production and was put into operation at South Meadow in 1929.

Economical Performance Of Latest Mercury Unit

Boiler operates at heat rate of 10,200 Btu per net kwhr. Overall costs are reduced by factory assembled tubes and headers

HARTFORD Electric Light Company's latest mercury-steam generating unit at the South Meadow station produced a net kilowatt-hour at a heat rate of 10,200 Btu during the first 28 days' operation. The unit is entirely new except for the condenser-boiler steam drums and vacuum shells, the mercury turbine generator and a portion of the mercury turbine exhaust shell. To insure reliable operation of the condenser boiler equipment, new steam generating tubes with water circulators were installed. Ample size of the previous 10,000-kw generator stator frame and rotor at South Meadow permitted these parts to be rewound to give a maximum of 15,000 kw at unity power factor.

The oil-fired mercury boiler has a completely mercury-cooled furnace, slag screen and mercury fog convection surfaces. Mercury vapor is generated within the tubes at 130 psig and at a saturated temperature of 964 F. From the turbine it exhausts into two vertical type side-mounted condenser boilers at 1.5 psia. In condensing, the mercury produces steam at 410 psig, which is superheated by the boiler flue gases to 700 FTT. The steam is then piped to the 385-psig station header for use in the steam turbine units. When desired, steam may be generated for use in the station's 250-psig turbines. A regenerative air preheater is used with the unit to insure satisfactory overall plant combustion efficiency.

In an effort to reduce overall costs as well as to cut down field assembly time of the boiler installation, factory fabrication of the furnace tubes with their liquid and vapor headers was successfully tried for the first time. The furnace has a flat refractory-covered floor intended for fuel oil burning only.

From a paper by Dwight Douglass, superintendent of power, Hartford Electric Light Co, and H. N. Hackett, General Electric Co, Schenectady, N. Y., at the spring convention of the American Society of Mechanical Engineers.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

Accelerated Life Tests Aid Cable Insulation Development

H. A. MORSS, JR.
Vice-President
Simplex Wire & Cable Co
Cambridge, Mass.

THE FULL potential value of short-time accelerated life testing as a guide in predicting the performance of a new product has not been realized in the past by the wire and cable industry. A broader concept of life testing, experience shows, leads to a fuller appreciation of such values.

In common practice, changes in tensile strength and elongation of rubber insulating compounds are the only properties that have been measured after conventional accelerated ageing in the oxygen bomb, the air oven or the air bomb.

Under the broadened concept many additional tests would be made after more severe accelerated ageing. The permanency as well as the initial values of various properties could thus be appraised. They are of equal importance. Two examples showing results of tests for ozone resistance and for water absorption will illustrate the importance of testing after accelerate ageing.

Rubber insulating compounds for wires and cables have for many years been tested for initial ozone resistance but no tests have been made to predict the permanence of that property. Recently several large electric utilities have observed that so-called ozone-resistant insulations gradually lost their ozone resistance. This occurs regardless of whether the cable is in actual service or is in storage. It has been found that ozone tests made after accelerated ageing point to just such behavior. Thus tests for ozone resistance, after ageing, foretell much more accurately how a new type of ozone-resistant insulation will compare in actual service with older types. A much more reliable prediction of life expectance and stability of ozone resistance can be obtained.

Another example of the advantages to be gained through testing after accelerated ageing is illustrated in the two charts showing effect of accelerated ageing on resistance to moisture absorption. The tests were made on an insulating compound which has good initial resistance to moisture and has been widely used under conditions where it is exposed to water.

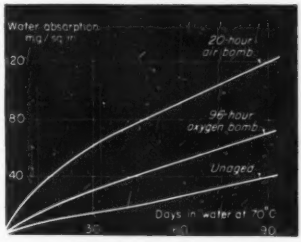


FIG 1—EFFECT of 4-day oxygen bomb and 20-hr air bomb ageing on mechanical water absorption property of a rubber insulation

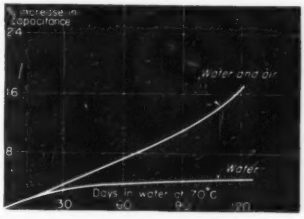


FIG 2—EFFECT of oxygen on change in capacitance of a rubber insulating compound immersed in water into which air in stirred

Figure 1 indicates mechanical water absorption after ageing 4 days in the oxygen bomb, 20 hr in the air bomb, and with no preliminary ageing. The aged samples absorbed much more water than the unaged sample and the quantity of moisture absorbed is greater when the ageing is more severe.

A similar comparison is seen in Fig 2. Here accelerated ageing in the form of oxidation is caused to occur simultaneously with water absorption by stirring air continuously into the water during submersion. In this test, change in capacitance indicates rate of deterioration and loss of essential properties. The more severe exposure with oxygen present causes much more rapid deterioration than the more conventional exposure in water containing little oxygen.

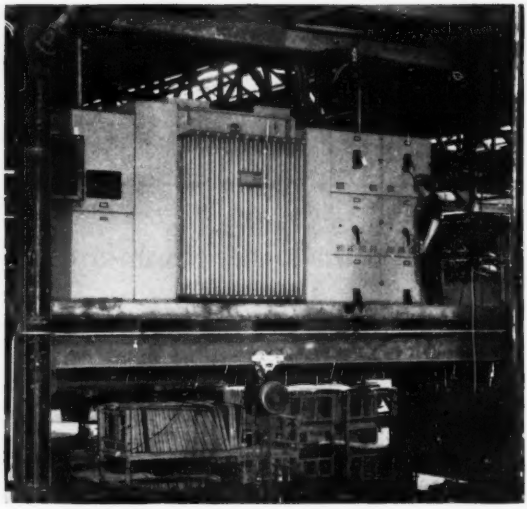
These illustrations and extensive field and laboratory experience demonstrate the great usefulness of accelerated ageing when combined with or preceding conventional testing for the appraisal of products and stability of essential properties. When properly selected, such combinations of tests can be included in specifications to give added assurance of long, satisfactory service.

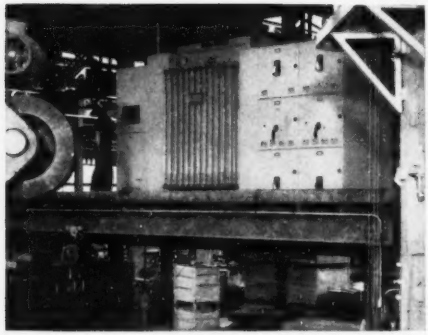
New Technique for Welding Chrome Pipe

A NEW PROCEDURE, devised by Houston Pipe and Steel, Inc, of Houston, Texas, is being used for welding 4-6 chrome pipe.

In the new process, as explained by M. Van Blaircom, Chief Engineer, a large preheating tip with oxyacetylene was used first to bring the temperature of the joint up to 600-800 deg and keep it there while the welding was done using chrome electrode General Electric Type W-1502 (ASTM-AWS Spec No. E-502). After this the temperature was raised to 1200-1350 deg and the joint was wrapped with asbestos tape to a minimum thickness of 1 in. and cooled to room temperature.

Contrary to popular belief this technique did not make the weld metal so hard that it became brittle. Laboratory tests certified by the Shil-



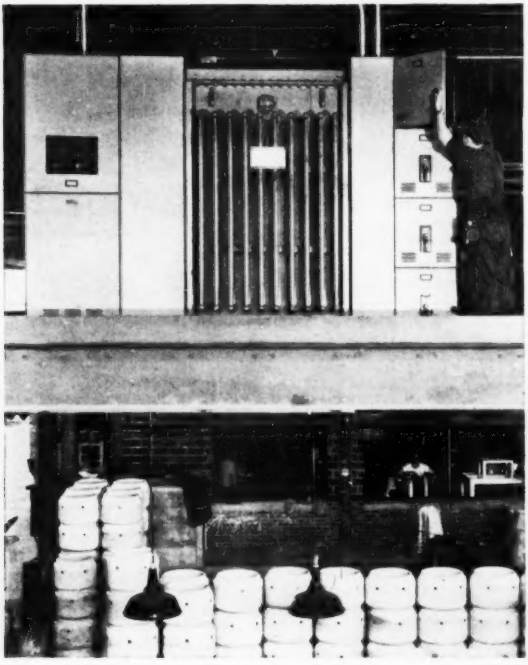


ALL UNIT SUBSTATIONS MOUNTED ON PLATFORMS TO SAVE FLOOR SPACE

Two views of General Electric 1000-kva load-center unit substation at new Maytag plant. Valuable manufacturing space is saved by locating units on platforms under the roof, right over the center of the load area. Air switch on primary is easy to operate, contacts are easy to see. Air circuit breakers on secondary are of the drawout type, easily removable for inspection and maintenance. Note entire load center is metal enclosed, thus offering operating safety to personnel.

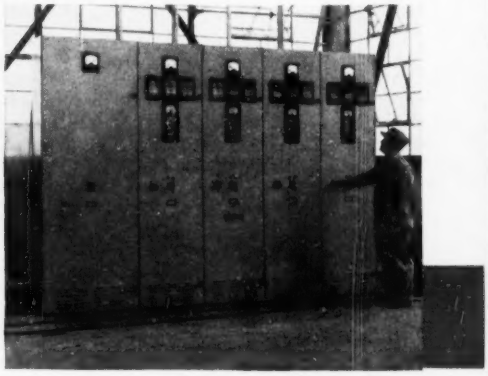
LOAD-CENTER

UNIT SUBSTATIONS

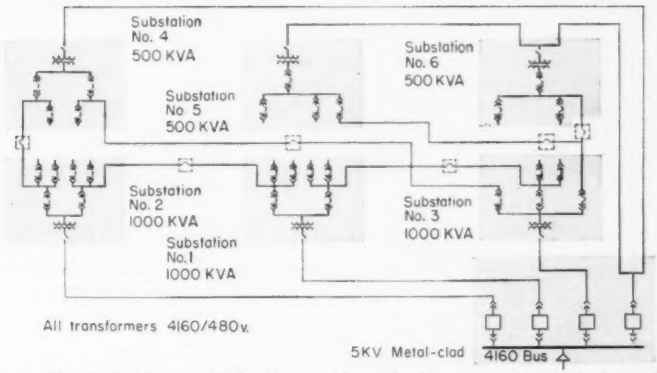


Unit substation No. 5, rated 500 kva. Air circuit breaker for future circuit can be inserted in empty upper housing. Drawout breakers are G-E Type AK-1 with 25,000 ampere interrupting rating—plenty of "IC" (Interrupting Capacity) to handle all short circuits. Contacts of 5 kv air switch are clearly visible through window, another safety feature of G-E substations.

G-E 5-kv metal-clad switchgear handles 4160 volts incoming power, distributes it to six load-center unit substations where it is stepped down to 480 volts for utilization. Metal-clad switchgear is neat in appearance, saving in space, and offers safety to operating personnel. Additional sections can be added for future expansion with a minimum of bother and expense.



CONTINUOUS POWER ASSURED MAYTAG BY SECONDARY-SELECTIVE DISTRIBUTION SYSTEM



This secondary-selective system at the new Maytag installation uses General Electric metal-clad switchgear to handle the incoming 4160 volts through four magne-blast power circuit breakers. Feeders distribute the 4160-volt power to six G-E load-center unit susbstations throughout the building where the high-voltage is stepped down to 480 volts for utilization—right at the center of the load area. This eliminates long, costly secondary feeders. Air switches on the primary of all load centers are rated 5 kv. Key interlocks give operating safety to personnel by preventing breaking of the load current with the air switch, or paralleling transformers.

With this secondary-selective system Maytag is insured against a power shutdown in case of failure of any one transformer or its primary feeder cable. If trouble occurs the normally open tie breaker is closed, thus providing an alternate source of power that permits the plant to operate at slightly reduced capacity.

The Maytag installation is a complete General Electric project—one source of responsibility plus the very best in coordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

HELP SPEED PRODUCTION AT THE NEW *Maytag* PLANT AT NEWTON, IOWA

ONLY G-E LOAD CENTERS GIVE YOU THESE FEATURES . . . .

SELECTED STANDARD ratings have been introduced by General Electric to bring you load centers on 20 per cent shorter shipments. The most popular are—

Low voltage	480 △ or Y, 208Y/120 volts
High voltage	2.4, 4.16, 4.8, 12, 13.2, 13.8 kv, delta
Kva ratings	300, 500, 750, 1000, 1500, 2000

Certain other *selected standard* load centers are available. Contact your G-E sales representative for further information.

NEAT APPEARANCE . . . Note the smooth, integrated appearance of these G-E unit substations . . . no more gawky, "old-type" stovepipe connections between transformer and switchgear.

SAVE TIME by eliminating weeks spent over drawing boards detailing individual items. G-E factory-assembled unit substations are quickly and easily installed with lower material and labor costs than required for "piece-meal," makeshift affairs. No last minute "alterations" with hacksaws and cold chisels to make them fit.

INVESTIGATE TODAY how General Electric unit substations can be used in your plant for efficient, flexible power distribution. Contact your G-E sales representative for further information, and write today for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3592 Load-center Unit Substations
GEA-3758 Load-center Power Distribution
GEA-3083 Metal-clad Switchgear
GEA-4057 Interlocked-armor Cable for Primary Circuits
GEA-4352 Flamenol Cable for Secondary Circuits

"For our new plant that manufactures Maytag automatic washers, we wanted the very best in power distribution systems. That's why we chose a secondary-selective system using General Electric load-center unit substations. We found that a system such as this would be more economical than any other type. Even though the initial cost was slightly higher than a simple radial system, the fact that we were assured of continuous power for our manufacturing facilities, even though a transformer or feeder cable should drop out, meant that we would save time and money in the long run. We also chose a load-center system because we can easily expand it to take care of any increase in our manufacturing facilities. We also bought 'standard' unit substations because we discovered they would do the job just as well as 'specials'—and at far less cost—and because we could get better delivery. After the units arrived they were installed on the platforms and were operating in a very short time. And dealing with one organization saved us time and money because we could get the engineering, equipment, and service all from one reliable source."

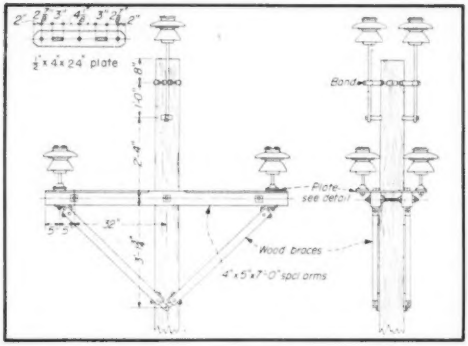
L. C. McAnly, Sr., Manager of Manufacturing,
The Maytag Co., Newton, Iowa

Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

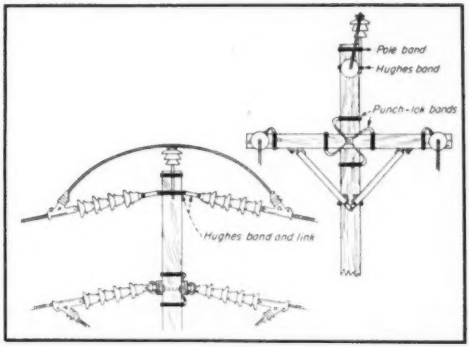
GENERAL ELECTRIC

stone Testing Laboratory of Houston showed desirable results. The figures showed an ultimate tensile strength of 73,200 psi, and a satisfactory rating on a 180 deg root bend. Brinell hardness in the weld was indicated as 248, while Brinell hardness in the pipe was 174. A Charpy Impact Notched test was made in the weld metal at 70 deg—49.0 ft-lb. Chemical analysis of the weld metal showed 7.73% chrome in the weld and 4.53% chrome in the pipe. Where greater ductility and elongation was required, a furnace anneal at 1,600 deg was given after the pipe had cooled. This resulted in an average elongation of 40% in 2 in.

Pole and Crossarm Banding Stops Leakage Burning



LEAKAGE BURNING on this 44-kv double crossarm construction after cutover to 69-kv has been remedied by banding of crossarm and pole with ⅜-in. steel and use of 69-kv insulators on the crossarm



GALVANIZED STEEL BANDS distribute electrical stress over a greater area to prevent burning. Four banks at center are clamped tightly together by the through bolt to avoid radio interference

BANDING OF POLES and crossarms has stopped leakage burning on 69-kv double crossarm structures of Public Service Co of Colorado. Operation at 69 kv of a 44-kv line using existing 44-kv construction for most of the line developed the problem. Leakage burning, due to high voltage stress on the wood, developed at the bottom of ridge pins on double arm structures, and burned off one pole at the crossarm. Double arm construction occurred at railroad and telephone line crossings with double ridge pins, double wood crossarms, and steel plates for double insulators on the crossarms.

Four-Insulator Dead Ends

Best results have been obtained by using dead ends consisting of four insulator units (69-kv standard) on each side of the pole on each conductor. Longer crossarms (10 ft instead of 7 ft) are also used. Dead ending at the ends of the arms with spacer bolts and bolt eyes in the normal way eliminates the use of pin type insulators to carry the jumper over the arm. Instead, elimination of charging current for the pin type insulator is accomplished by carrying

L. M. ROBERTSON
Assistant Supt
Hydroelectric Production and Transmission
Public Service Co of Colorado
Denver

the jumper under the arm.

Outer end of each arm is banded at the spacer bolt, and the end of the band is put between the bolt eye and a washer under the nut. The band is placed close to the spacer bolt so it is under the washer on the inside of the arm and the bolt eye on the outside of the arm.

Bands are also applied around the pole, above and below the arm, and around the arm about 7½ in. from the crossarm through bolt. Ends of the four bands are left long enough to be caught beneath a special washer made of thin steel cut about two inches square. This washer is held between the nut of the through bolt and another washer, which is in turn held by a lock-nut. This arrangement keeps the bands tied tightly together to avoid radio interference.

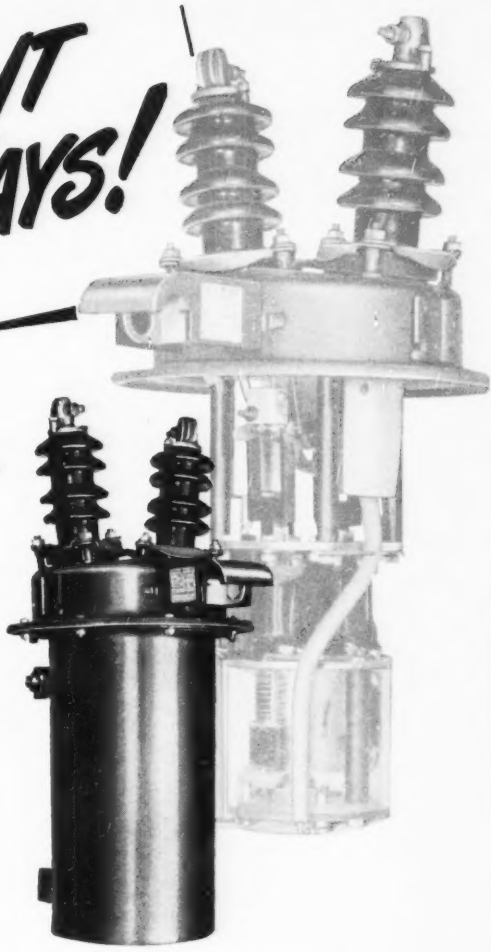
The line is dead-ended at the top of the pole with a conventional Hughes band. A 69-kv silent type insulator on a steel ridge pin carries the jumper over the pole. A small band above the eye bolt at the top of the pole is used primarily for mechanical strength. There is no connection between this banding and the crossarm through bolt banding, nor down the pole to ground.

Galvanized steel ⅝ in. wide by 0.023 in. thick is used for the bands. They are long enough to go twice around the pole and be clamped under the bolts as shown. Distance of the bands from the through bolt is not thought to be critical. The band around the pole above the arm might be closer to the arm than five inches above the bolt, but the lower band has always been placed at least 7 in. below the bolt.

No Burning Since 69-kv Cutover

Since the cutover to 69 kv there has been no burning of poles, arms, or braces on structures with single pin or H frame construction, or corners with suspension insulators. Operating experience on the line indicates that a 44-kv line using 55-kv silent-type insulators on wood poles with wood crossarms, braces, guy insulators and a ridge pin as shown, can be operated satisfactorily at 69 kv. Lightning tripouts have been

COMPARE IT THREE WAYS!



The FR-1 Relayed Automatic Recloser

1 FOR MINIMIZING OUTAGES

Fuses and conductors are protected by instantaneous first and second operations—very fast openings—regardless of ambient temperature, viscosity or condition of oil.

- False operations are prevented by precision timing—plus relay control of the interrupter—and, again irrespective of temperature or oil.
- Re-setting is 5- to 15-times faster than other types of reclosers—protecting against rapidly recurring temporary faults, even successive line flashovers by lightning strokes seconds apart.
- Inrush current cannot instantaneously retrip recloser.
- Fewer outages on every score.

2 FOR ECONOMIES IN MAINTAINING SERVICE

Fewer outages mean, of course, fewer service trips. Moreover the unavoidable outages can be located more quickly and service restored in less time.

- With the FR-1, many series fuses can be used to further sectionalize the system with permanent faults always confined to a minimum number of consumers. As many as 4 to 7 different ratings of fuses can be reliably co-ordinated with each rating of recloser because of the established minimum and maximum characteristics of the recloser and year-round accuracy.

3 FOR ENDURANCE IN SERVICE

Oil Blast interruption of arc in ½ cycle means longer life—minimum wear of arc-resisting Elkonite contacts and minimum carbonization of oil.

- Gears of heavy-duty escapement timer are case-hardened and plated. Timer operates in air above the oil, for lasting fidelity of timing and independence from temperature changes or viscosity of oil.
- Coils will withstand continuous current up to two times rating (up to minimum pickup current) without damage—unexpected overloads can't hurt the coils.
- Built-in Thyrite valve element by-passes lightning and surge voltages—protects turn insulation of coils.

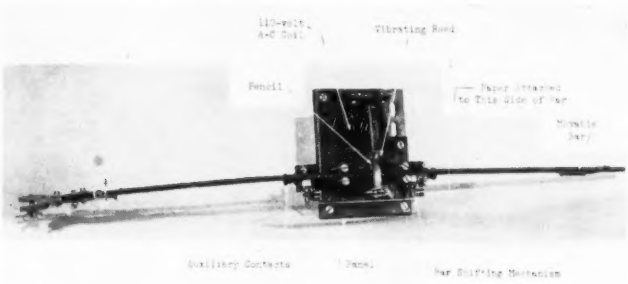
Bulletin GEA-4934 describes in detail this unique recloser, gives data on co-ordination with fuse links and tells about its "locked-closed" alternate operating function (convertible in the field) which simplifies and extends co-ordination with fuses. For your copy address your G-E Apparatus Sales Office or write *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

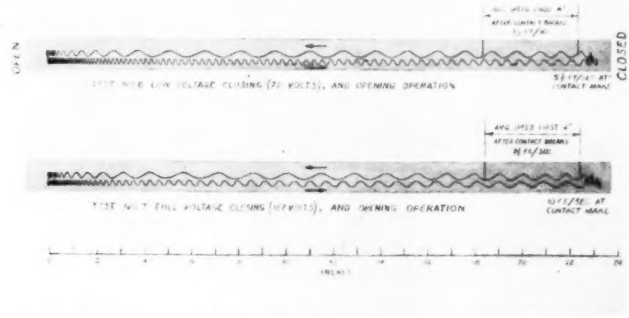
4K6-24

comparable—11 in 1947, 4 in 1948 at 69 kv, 14 in 1945 and 13 in 1946 at 44 kv. Size of conductor, which affects corona loss, and amount of insulator contamination have an important influence on such operation. Where double insulator ridge pin on double arm construction is used, it may well be necessary to use 69-kv insulators and band arms and poles as described so that leakage burning will be obviated.

Recorder Measures Velocity of Moving OCB Contacts



GRAPHIC TRAVEL TIME recorder designed to measure velocity of moving contacts in circuit breakers. Pencil attachment is included on the free end of the resilient steel reed



GRAPHIC RECORD of closing and opening operations for part of the moving contact stroke

A. C. BAUMANN
Chief Inspector
and
FRANK KUNZE
Asst Chief Inspector, Electrical System
The Detroit Edison Co

A GRAPHIC INSTRUMENT known as a "travel recorder" has been developed to measure velocity of moving circuit-breaker contacts in the travel stroke. Speed data can be obtained also on both the opening and closing operations which must be maintained within specified limits.

Major elements of the recorder are illustrated. Armature of the a-c electromagnet is attached to a resilient steel reed. A pencil attachment is included on the free end of the reed. When the magnet coil is energized the reed vibrates at twice the frequency of the exciting current, e.g. 120 and 60 cycles. The moving bar is connected directly to the movable contacts of the circuit breaker. With this arrangement, the full stroke of the breaker is recorded directly on the paper tape. Axial movement of the bar with the attached paper tape together with the transverse movement of the pencil produces a graph record as shown.

Reversal of breaker contact motion causes the moving bar with paper to shift $\frac{5}{16}$ in. relative to the position of the pencil, thereby producing separate graphs on closing and opening during a closing-opening operation of the circuit breaker.

Two sets of auxiliary contacts are furnished. These contacts close at the completion of either the full-closing or full-opening stroke. They are used in combination with the cycle counter where it is desired to obtain the timing interval from the start of an operation which includes the operating time of the associated auxiliary equipment.

For interpretation of the graphs, the following formula is used: $V = (10xS) / T$, where V = average velocity of any part of the travel stroke in feet per second, S = linear distance in inches, and T = number of cycles appearing within the distance measured. The graphs show the application of the formula in determining the velocity measurements for a particular part of the moving contact stroke in a 120-kv circuit breaker.

Account Tickets Eliminate Need for Detailed Reports

PAYROLL and transportation unit account tickets are used as ledger posting media by the Wisconsin Power and Light Co. They are prepared in duplicate in each district once a month by the use of interleaf carbon. The duplicate copies are used as a district record of payroll and transportation charges.

Use of these tickets eliminated the necessity of preparing 14 detailed operating reports each month, one for each district. Carbon copies of the tickets are available in the districts not later than the third of each month while the operating reports previously prepared were not available until the 25th of the month. Maintenance of 14 sets of ledger records in the General Office Accounting Department was also eliminated. Payroll data was found to be sufficient for effective district control of operations.

HERE ARE ALL THE FACTS ON RM* POWER TRANSFORMERS

*Certain G-E power transformers, within the complete G-E line, have for a number of years been designated as "repetitive manufacture," or "RM" for short. These are standard transformers—that lend themselves to quantity production.

Through quantity production RM transformers can be built faster, at lower cost. Engineering and drafting for any particular transformer is already done—component parts can be mass-produced—jigs and fixtures are already on hand.

As a result, RM transformers can be delivered months sooner than non-RM transformers. Their prices are lower, by at least eight per cent, than specials of identical ratings.

"RM" transformers are available in ratings of 667 to 5000 kva, single-phase, and 750 to 10,000 kva, three-phase and with high voltages in accordance with EEI-NEMA preferred voltage ratings between 2400 and 67,000 volts. They are equipped with the most popular types of terminals and accessories.

A NEW 44 page catalog gives you

Prices • Ratings

Electrical and mechanical data

Application and selection data

Lists and descriptions of basic accessories and optional features

If you haven't received your copy of GEC-479, call your local G-E office or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

Customer-Owned Service Poles—II

Minimum requirements shown on sketches and outlined in notes have been approved by California Public Utilities Commission on the basis of drawings submitted by an electrical utility. Standards for both public and private utility-serving agencies will be approved on a similar basis as drawings are submitted. References notes, service drop clearances and meter connections are outlined here. Pole construction and attachments for service drops and meters were presented in Engineering Reference Sheet No. 49-39.

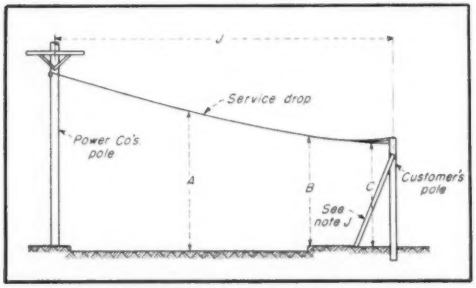


FIG 3—CLEARANCE FOR SERVICE DROP from the power company's pole to customer's pole. Height at center of street 18 ft. min. Company requirements govern other clearances

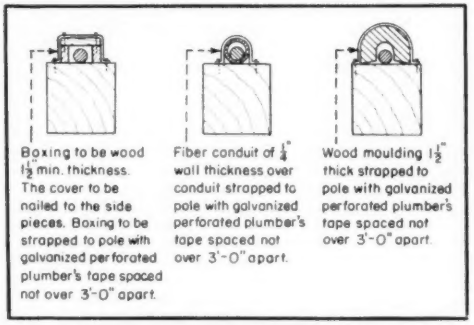

Boxing to be wood ½" min. thickness. The cover to be nailed to the side pieces. Boxing to be strapped to pole with galvanized perforated plumber's tape spaced not over 3'-0" apart.
Fiber conduit of ¼" wall thickness over conduit strapped to pole with galvanized perforated plumber's tape spaced not over 3'-0" apart.
Wood moulding 1½" thick strapped to pole with galvanized perforated plumber's tape spaced not over 3'-0" apart.

FIG 4—METHODS OF COVERING CONDUITS—boxing, fiber and moulding strapped to pole with plumber's tape, 3 ft max spacing

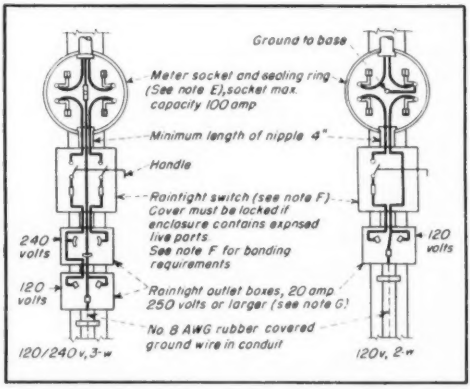

Ground to base
Meter socket and sealing ring (See note E), socket max. capacity 100 amp
Minimum length of nipple 4"
Handle
Raintight switch (see note F) Cover must be locked if enclosure contains exposed live parts. See note F for bonding requirements
240 volts
120 volts
120 volts
Raintight outlet boxes, 20 amp 250 volts or larger (see note G)
No. 8 AWG rubber covered ground wire in conduit
120/240 v, 3-w
120 v, 2-w

FIG 5—METER, SWITCH and outlet box connections for temporary service poles. Main switch and outlet boxes to be raintight

NOTES

A. Height at center of street, 18 ft min. (For height over trolleys, railroad track, etc consult the Power Co).

B. Height at curb line, 16 ft min. Height over private driveways, lanes or other private areas accessible to vehicles used for industrial or commercial purposes, 16 ft min.

C. Construction shown in Fig 1 and 2 will provide required clearance of service-drop conductors over streets and curbs for most installations. If heights specified in Notes A and B above cannot be obtained with a 20-ft pole (over-all length), then a longer pole must be used except as provided for in Note M. Pole to be set a minimum of 4 ft in ground.

D. Rigid conduit, ¾ in. min. All conduit fittings to be raintight. Rubber-covered wire not less than No. 8 AWG shall be used.

E. On poles more than 16 ft above ground the maximum height of meter must not exceed 7 ft, and the switch handle 6 ft 6 in. above ground.

F. Main switch to be raintight or adequately protected from the weather and of proper rating for load to be served. Switch cover must be locked if enclosure contains exposed live parts. Service entrance circuit breaker may be used in lieu of fuse-switch. Unless threaded connections are employed, adequate bonding of all sections of the service equipment shall be provided.

G. Outlet boxes must be raintight or otherwise adequately protected from the weather. Receptacles shall be of proper rating for the load to be served. Receptacles used to connect portable tools shall be the 3-pole type for single-phase motors and the 4-pole type for 3-phase motors, one clip to be used for ground connection. Where more than one voltage is used, the receptacles shall not be interchangeable.

H. When required, permit and inspection must be obtained from city or county inspection authorities before service will be connected by the Power Co.

I. When service larger than 60 amp is required or 3-phase service is desired consult the Power Co.

J. (1) Pole not to be placed closer than 10 ft to surface of utility pole. (2) Where service-drop span length is greater than 80 ft, customer's pole shall be down-guyed or push-braced against pull of service-drop conductors. Push brace shall be not smaller than 2x4 in. timber securely nailed or bolted to pole.

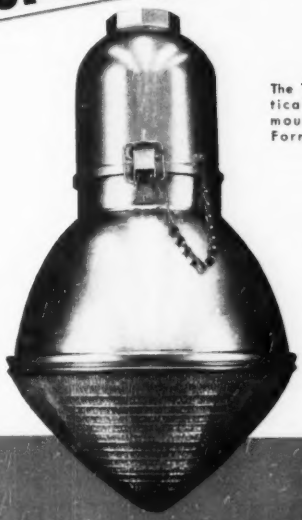
K. Square poles shall be of a minimum cross section of 6x6 in. and a minimum of 20 ft in length. Round poles having a top diameter of 5 in. or larger are preferable where obtainable. Where poles are set for permanent installations, Redwood timber is recommended, and if other kinds of wood are used creosote (or an equivalent preservative) shall be applied to the butt from a point at least 12 in. above the ground line. Push braces on permanent installations shall be similarly treated with wood preservative on the ground end.

L. Customer should furnish a crossarm if the upper 2-ft section of the pole is needed to provide the required clearance of the service-drop conductors. Where a crossarm is furnished by the customer, it should be attached at top of pole with a ½-in. machine bolt and pole gained to a depth of ½ in. Minimum size of crossarm shall be 4x4x42 in.

M. On temporary installations only, a pole-top extension with a crossarm may be used with a 20-ft minimum pole where such construction will provide the required ground clearance. Such pole-top extension shall be solid timber 4x4 in. (minimum) not over 48 in. long attached with two ½-in. machine bolts; the length of the splice shall be not less than 24 in.

what's **New** in street lighting

A High-Efficiency Residential Optical Assembly for Modest Budgets



The Type RV optical assembly mounted on a Form 79 hood.

General Electric offers this new high-efficiency optical assembly for safe, attractive lighting of residential or light-traffic streets at a price even modest budgets can afford.

Efficient Light Distribution

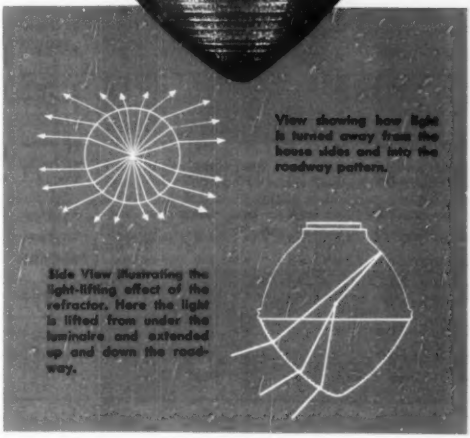
Type RV optical assembly produces a long, narrow, two-beam distribution (IES Type I), making it excellent for very long spacing (10 to 12 times mounting height). Where the desired footcandle value is about 0.2 and economy of 4,000 or 6,000-lumen lamps is needed, the Type RV is the ideal choice.

The Type RV has a newly developed reflector which directs light down into a new Holophane VERTILATERAL refractor, specially designed to turn and lift light into a carefully controlled, long, rectangular pattern.

This luminaire has been designed for Comfortable Seeing. It has deep shielding and sharp cut-off above angles of maximum candlepower for less glare—excellent side shielding to keep the light down on the road where it's wanted—a rectangular pattern of light for long economical spacing.

Flexibility

And the Type RV fits in with standardization programs. It can be mounted on any Form 79 or 101 hood. The glassware can be spun-sealed to the reflector or assembled by clamp band or roller latch. For complete information write *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



View showing how light is turned away from the house sides and into the roadway pattern.

Side View illustrating the light-lifting effect of the refractor. Here the light is lifted from under the luminaire and extended up and down the roadway.

GENERAL ELECTRIC

452-89

A Guide to Standard Equipment For Kilowatt-hour and Demand Metering

For various services to be metered, accompanying table provides the rating and type of meters required also the instrument transformers required. This listing is adapted from meter practices of Mississippi Power & Light Co, Jackson, Miss.

Meter Ratings and Types for Various Power Services

Service to be Metered				Rating of Meter Required					Instrument Transformers Required	Type Watthour Meter	Type Indicating Demand Meter	Type Recording Demand Meter
Amp	Volts	Wire	Phase	Amp	Volts	Wire	Phase	Element				
0- 45	120	2	1	15	120	2	1	1	None	CS; MFS I-30S; JS	WDS; CSH TFS	
45-100	120	2	1	50	120	2	1	1	None	CS; MFS I-30S; JS	WDS	
0- 45	120/240	3	1	15	240	3	1	1	None	CS; MFS I-30S; JS	WDS TFS	
45-100	120/240	3	1	50	240	3	1	1	None	CS; MFS I-30S; JS	WDS	
Over 100	120/240	3	1	2.5	120	3	3	2	2 C.T.	V-3A	M-20 WDP	CCW
0-45	120/208	3	Open Y	15	120	3	3	2	None	V-2S LC-2S	WDS	
45-100	120/208	3	Open Y	50	120	3	3	2	None	V-2S LC-2S	WDS	
Over 100	120/208	3	Open Y	2.5	120	3	3	2	2 C.T.	V-3A	M-20 WDP	CCW G-9
0-45	240	3	3	15	240	3	3	2	None	V-2S LC-2S	WDS	
45-100	240	3	3	50	240	3	3	2	None	V-2S LC-2S	WDS	
Over 100	240	3	3	2.5	240	3	3	2	2 C.T.	V-3A	M-20 WDP	CCW G-9
0-45	120/208	4	3 Y	15	120	4	3 Y	2	None	V-5S	WDS	CCW
45-100	120/208	4	3 Y	50	120	4	3 Y	2	None	V-5S	WDS	CCW
Over 100	120/208	4	3 Y	2.5	120	3	3	2	3 C.T.	V-5A	M-20 WDP	CCW G-9
0-45	120/240	4	3	15	240	4	3	2½	None	LC-2S V-6S	WDS	
45-100	120/240	4	3	50	240	4	3	2½	None	V-6A CA-9	WDP RW	CCW
Over 100	120/240	4	3	2.5	240	4	3	2½	3 C.T.	V-6A	M-20 WDP	CCW G-9
0-45	120/240	3 & 3	3 & 1	15	240	2 circuit	Totalizing	3	None	V-10A CA-9	M-20 RW	G-9
45-100	120/240	3 & 3	3 & 1	50	240	2 circuit	Totalizing	3	None	V-10A CA-9	M-20 RW	G-9
Over 100	120/240	3 & 3	3 & 1	2.5	240	2 circuit	Totalizing	3	4 C.T.	V-10A	M-20	G-9
All	480	3	3	2.5	120	3	3	2	2 C.T. 2 P.T.	V-3A	M-20 WDP	CCW G-9
All	2400	2	1	2.5	120	2	1	1	1 C.T. 1 P.T.	I-30A	M-20 WDP	CCW G-9
All	2400	3	3	2.5	120	3	3	2	2 C.T. 2 P.T.	V-3A	M-20 WDP	CCW G-9
All	2400/ 4160	4	3 Y	2.5	120	4	3	2	3 C.T. 2 P.T.	V-5A	M-20 WDP	CCW G-9
All	8400 or 14400	2	1	2.5	120	2	1	1	1 C.T. 1 P.T.	I-30A	M-20 WDP	CCW
All	8400 or 14400	4	3 Y	2.5	120	3	3	2	3 C.T. 2 P.T.	V-5A	M-20 WDP	CCW PD-5
All	14400	3	3	2.5	120	3	3	2	2 C.T. 2 P.T.	V-3A	M-20 WDP	CCW PD-5
All	Above 14400	4	3 Y	2.5	120	4	3 Y	3	3 C.T. 3 P.T.	V-4A		PD-5

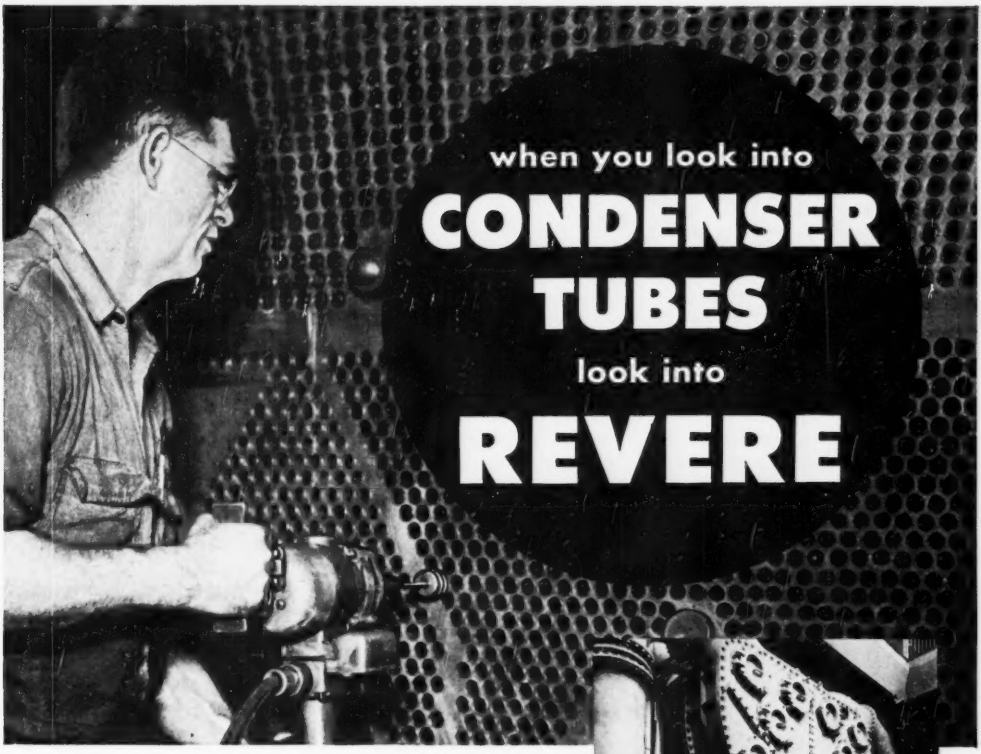
Meter Designation Code

Type	Mfr.
Watthour Meters	
CA-9	Westinghouse
CS*	Westinghouse
I-30A	General Electric
I-30S*	General Electric
JS*	Sangamo
LC-2-S*	Sangamo
MFS*	Duncan
V-2S*	General Electric
V-3A	General Electric
V-4A	General Electric
V-5S*	General Electric
V-6A	General Electric
V-6S*	General Electric
V-10A	General Electric
Indicating Demand Registers	
M-20	General Electric
RW	Westinghouse
Thermal Demand Meters	
CSH*	Westinghouse
TFS*	Duncan
WDP	Sangamo
WDS*	Sangamo
Recording Demand Meters	
CCW	Sangamo
G-9	General Electric
PD-5	General Electric

NOTES

Watthour meters and demand meters have the "A" type mounting, except those marked by an asterisk (*) which are socket type. Demand registers are a component part of the watthour meter.

Demand meters recommended only apply where necessary to conform to rate applications.



. . . and be assured of Top Performance

Because each condenser installation presents an individual combination of conditions, it is not possible to recommend any one alloy that will give complete satisfaction under all operating conditions.

For example: in the condensers (shown above) being made by the Elliott Co. of Jeannette, Pa. for the Ohio Edison Company, the tubes are Revere Admiralty Metal, inhibited to resist dezincification. This metal also is highly resistant to other forms of attack. The result is a set of condenser tubes that are best suited to the operating conditions of this particular installation.

To find the alloy or combination of alloys best suited to meet the specific operating conditions of *your* condensers, Revere offers you the help of its Technical Advisory Service. Working with the engineers of the country's leading users of condensers and heat exchangers these capable consultants, over the years, have helped solve many and varied types of problems. This knowledge and experience is at your service, ready to help you get longer life from your condensers.

That's why Revere suggests that, before you specify your next new set of condenser tubes or replace those in one of your present installations, be sure to look into Revere.

REVERE

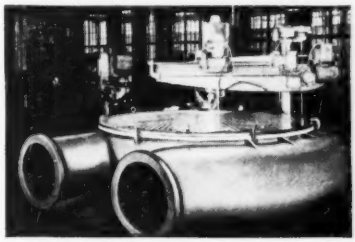
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

View of condenser built by the Elliott Co. for the Mad River Station of the Ohio Edison Co., Springfield, Ohio. It is an 18,200 sq. ft. two-pass divided water-box type, equipped with 3480 1" O.D. x #18 B.W.G. x 20' 3" long Arsenical Admiralty Revere Tubes.



TUBE PLATE OF REVERE MUNTZ METAL for an 11,000 sq. ft. surface condenser, to be installed for a Texas utility, being drilled in the shops of the Elliott Co., at Jeannette, Pa.

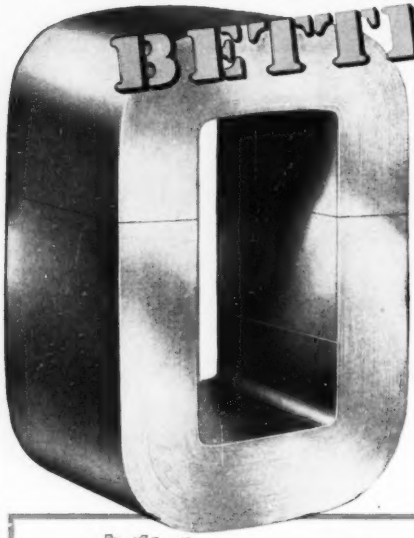
THE *NEW* MOLONEY

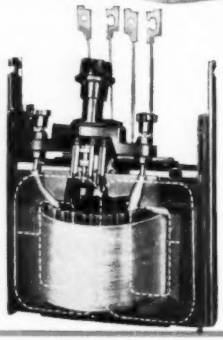
*HiperCore**

DISTRIBUTION TRANSFORMERS

*CORES MADE OF HIGH PERMEABILITY, ORIENTED, SILICON STEEL

BETTER VOLTAGE





Dotted line in illustration at left, indicate position of core in assembled core-and-coil unit. After cores are wound, they are annealed, impregnated and then cut into pairs of U-shaped pieces. Two large U-shaped pieces are placed side by side, forming an inner and two outer core legs. Then the windings are placed over the inner core leg. Next, the two matching U-shaped pieces are placed into position to complete the magnetic circuits. A thermo-setting adhesive bonds the core faces together.

BETTER VOLTAGE REGULATION AT ALL LOADS

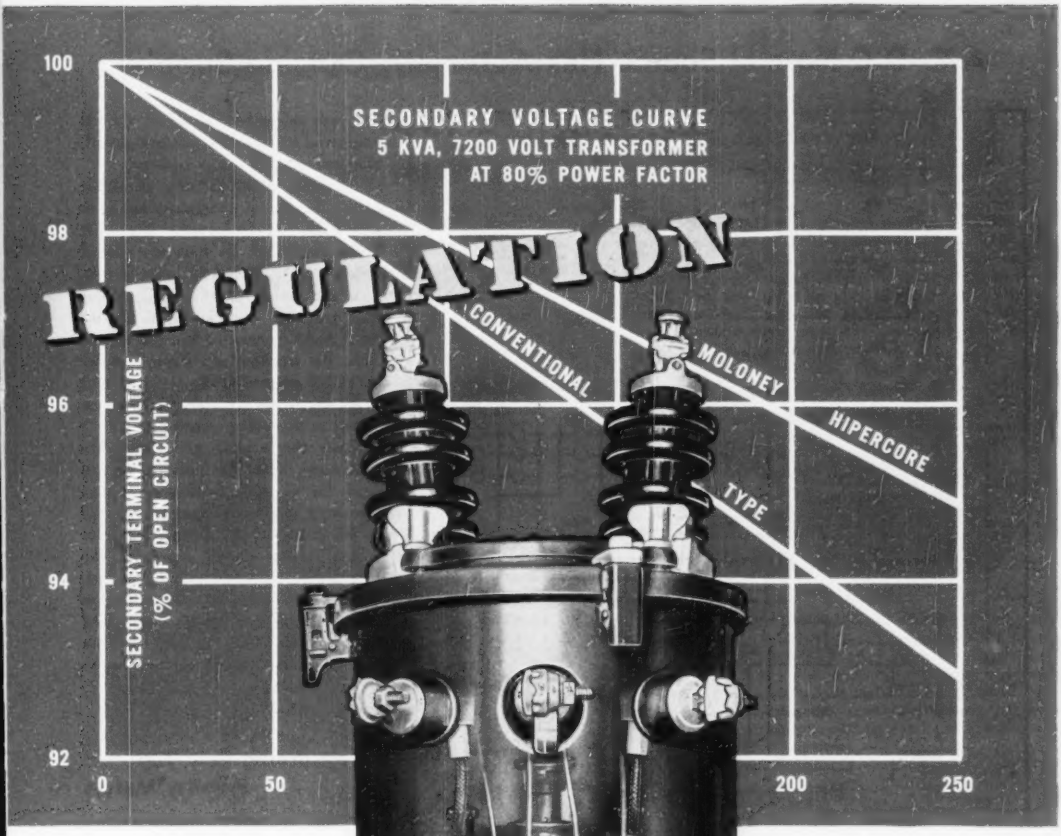
Development of the new Moloney HiperCore Transformer has made possible a reduction in transformer impedance, resulting in better voltage regulation. These wound core transformers, being smaller physically, have inherently lower impedance than transformers of conventional core design.

Better voltage regulation means better all-around system performance. Secondary voltage fluctuations, due to sudden or intermittent load changes, are reduced. Secondary voltages may be maintained at a higher level resulting in improved performance of the connected load.

In many installations emergency loading is controlled largely by transformer voltage regulation. Moloney HiperCore Distribution Transformers, having better regulation, can carry higher overloads with the same permissible voltage drop.

MOLONEY

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT



GREATER SHORT-TIME OVERLOAD CAPACITY

Moloney HiperCore Transformers have improved short-time overload characteristics which provide better peak load performance and longer life. Reduced coil mass, achieved through use of oriented steel cores, together with the extensive use of cooling ducts, results in more rapid cooling of the windings and in a lower hottest-spot temperature gradient.

LIGHTER WEIGHT

The 30% to 35% higher flux carrying capacity of the oriented core steel used in HiperCore Transformers makes possible the use of smaller cores and windings, with consequent reductions in the weights of steel, copper, oil, and other materials. HiperCore Transformers weigh 15% to 30% less than transformers having cores made of hot rolled steel, making them easier to handle and install.

SMALLER SIZE

Since the higher flux carrying capacity of oriented steel permits the use of smaller cores and windings, smaller tanks can be used. Reductions in size range up to 30%. HiperCore Transformers take up less space on the pole, in the storeroom, and on the line truck.

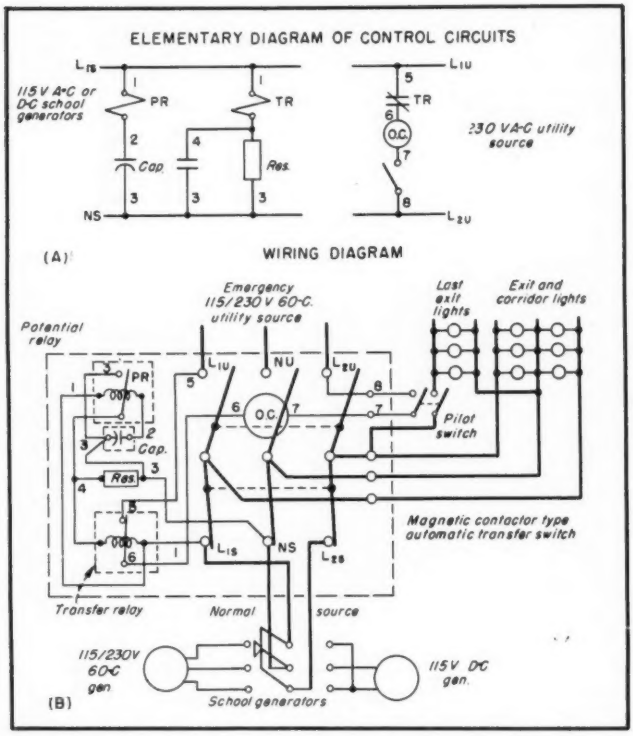
SUPERIOR TAP CHANGER DESIGN

The "snap action" movement of the tap changer used on Moloney HiperCore Transformers assures positive pressure at all times. The handle is above the hot oil level and the dial can be read from the handhole opening. The body of the tap changer is made of high-impact-strength phenolic resin for high insulation and elimination of breakage. Use of high contact pressure and oversize contact surfaces insures low temperature rise and eliminates pitting or burning.

ELECTRIC COMPANY

SAINT LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

A-C–D-C Normal Source Has Automatic Outside Supply



WIRING DIAGRAM of control circuits and automatic transfer switch to throw emergency lighting circuits on utility supply when school generators are off the line. (A) Elementary diagram; (B) Detailed wiring diagram showing that load is always closed on one of the sources

FRANK E. REEVES
Barnard & Burk
Baton Rouge, La.

UPON FAILURE of a technical school's source of normally self-generated a-c or d-c power, a control circuit automatically transfers the emergency lighting to a standby public utility supply.

The technical high school uses a-c and d-c steam-driven turbo-generators for lighting and for instruction in steam and electrical generation. A magnetic contactor type of transfer switch is used for economy. This consists of a 3-pole, double-throw, 60-amp contactor. The normally closed contacts are spring and gravity-held when the main operating coil is de-energized. The contactor has no neutral position, so the load is always closed on one source or the other. To avoid the continual a-c hum inherent in this type of unit, the normal source of supply is connected to the normally closed bottom contacts. Therefore, the main operating coil of the contactor is energized only during the emergency condition when the normal source is dead.

In the diagram (A), a 2-mfd capacitor is connected in series with a potential relay *PR* which pulls in only on a-c. When the d-c school generators are running, this relay remains de-energized. Its normally open contacts are, of course, open under this condition, and the coil of the transfer relay *TR* has a series resistor to prevent burnout. If the a-c school generators are on the line, the coil of potential relay *PR* is energized and its contacts are closed, shorting out the series resistor.

In either case, as long as either a-c or d-c school generators are running, the coil of transfer relay *TR* being energized, its normally closed type of contacts will be open to prevent the main operating coil *OC* of the transfer switch from being energized. When the normal source fails, the transfer relay becomes de-energized, causing the operating coil to be energized and the load transferred to the utility source.

Since the school generators are shut down when the building is not used for evening functions, it was necessary to prevent transfer of load to the utility at those times. A pilot switch in the circuit supplying the exit lights was equipped with two poles. One was used to shut off these last exit lights and the other was used to prevent the operating coil from being energized from the utility source in "off" periods.

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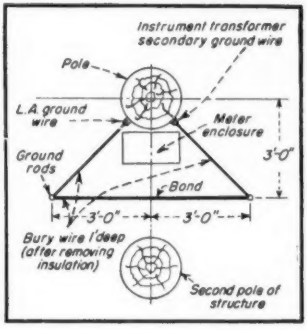
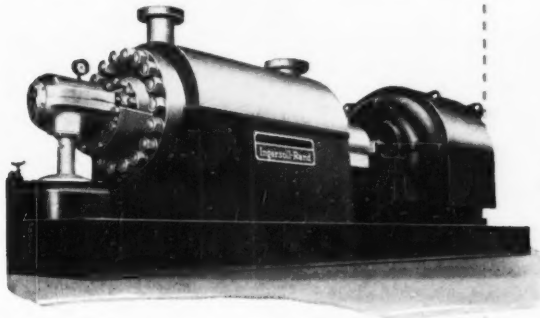
Safeguarding Pole Top Primary Meters



AN ECONOMICAL arrangement for grounding pole top primary meters on 3-phase, 3-wire, 4-kv maximum circuits is used by an eastern utility system.

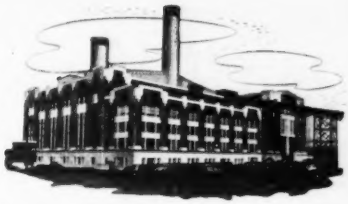
Instrument transformer cases are not grounded. Instrument transformer secondaries and meter enclosures *are* grounded by a wire run from the meter cabinet to a driven ground rod. In doing this

HERE'S WHY
Ingersoll-Rand
BOILER-FEED PUMPS
are
FIRST CHOICE
for really
HIGH PRESSURES

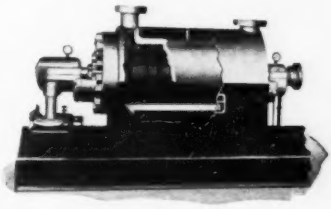


When so many leading Central Stations repeatedly specify Ingersoll-Rand boiler-feed pumps for the highest operating pressures in use today, you can be sure there are good reasons for this preference. Here are three of them—*dependability, ease of maintenance,* and *appearance*—all important considerations in the modern, high-pressure steam generating plant.

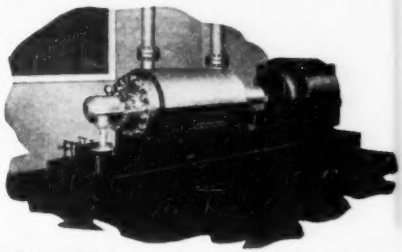
I-R high-pressure boiler-feed pumps, Class CHTA and CHTB, are multi-stage, single-suction, diffusor-type units, built for discharge pressures of from 1000 to 3000 psi—in capacities to 2800 gpm at temperatures up to 800° F. But *whatever* pressure or capacity you need, Ingersoll-Rand can supply a boiler-feed pump for the job. I-R engineers will be glad to help you select the pump that best meets all of your specific requirements.



DEPENDABILITY is probably the most important single requirement in all central station equipment. And here, I-R double-case boiler-feed pumps have chalked up a record that speaks for itself. Many of these high-pressure units have been in service for over 12 years—with little or no attention! And more than 40% of the units sold are on *repeat* orders—from users who have already proved this dependability in their own plants.



EASIER MAINTENANCE, and less of it, is an inherent feature of the new I-R Class CHTA and CHTB pumps. They are of "double-case" construction which permits maximum accessibility and greatly simplifies regular maintenance procedure. You save hours, or even days of "down-time" on dismantling and assembly operations too, because the entire inner casing assembly can be removed as a unit in a surprisingly short time.



APPEARANCE is becoming an increasingly important factor in the modern Central Station. And the sleek, streamlined design of I-R boiler-feed pumps is entirely in keeping with the trend in modern equipment. Many of the lubricating system components have been integrated into one compact assembly, thus eliminating much external piping. Sheet metal lagging over the casing blends in with the main pump support.

***FOR COMPLETE** information on Class CHTA and CHTB high-pressure boiler-feed pumps call the nearest Ingersoll-Rand branch office. Ingersoll-Rand manufactures all types and sizes of centrifugal pumps.*

Ingersoll-Rand
Cameron Pump Division
11 Broadway, New York 4, N. Y. 389-10

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

EVERSTICK ANCHORS...

First Choice for

PERMANENCE
HOLDING POWER
LONG LIFE
SAFETY

They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "The Anchor of Merit"
FAIRFIELD, IOWA

work the insulation is removed from the horizontal portion of the ground wire running from the pole to the ground rod. The ground rod is driven until its top is 12 in. deep. Any lightning arrester ground wire is run continuously to a separate driven ground in the same fashion. The two ground rods are bonded together by bare wire buried about 12 in. deep. This is the only case the company allows where any transformer secondary grounds and lightning arrester grounds may be bonded or installed less than one span apart.

In cases where the meter installation is on the customer's premises, the instrument transformer secondaries and meter enclosure are not allowed to be connected to the lightning arrester ground. Instead, grounding is accomplished by connecting to the customer's ground only. All primary meter installations, unless within 150 ft of existing arresters or within shielded areas, are required to have the protection of lightning arresters.

Cash Register Cuts Cashier Costs

THE INSTALLATION of a new cash registering system now enables two cashiers to handle all bill payments to the Carroll Electric Membership Corp. at Carrollton, Ga. It is a job that formerly kept five cashiers busy. R. E. Muse, manager of the co-op, says that the saving, amounting to over $5,000 a year, was made possible by substituting certifying cash registers for tin cash boxes.

Consumers on the lines of the co-op read their own meters and make out their own bills. Once a month the meter card and bill are presented to the cashier with the money in payment. Under the old system the cashier made change out of the tin box, separated the two halves of the meter card, stamped one "Paid" and returned it to the customer. The half of the meter card which was retained by the company was used for posting and was the only evidence of the transaction.

Obviously, there was a lot of chance for error. Meter-card stubs were lost or mislaid, consumers' accounts were not credited, and the daily cash account refused to balance. Chasing such errors took much time and consumers who had paid their bills were naturally quite unhappy to be informed that their accounts were delinquent, particularly since a 10% penalty was chalked against them.

R. C. Allen Business Machines, Inc, Photo

QUICKLY, accurately, Adele Shirey, CEMC cashier, handles bill payment by a consumer

Under the new set-up the consumer hands the cashier his meter reading card. The cashier inserts a small duplicate customer receipt into the machine. Next she indexes the alphabetical prefix and the numerals designating the account number and the amount due. She then depresses the motor bar, all three items are simultaneously printed in triplicate, and the cash drawer opens. The original receipt is given to the customer, the duplicate is filed for posting and accounting, and a printed unchangeable record is made of all payments on the daily detail tape.

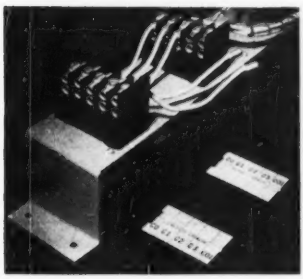
If the customer's account is overdue, the penalty is added merely by moving the receipt a little to the left and indexing the amount. This was formerly a pad and pencil operation which consumed a great deal of valuable time.

Since a printed record is made of each transaction, the co-op has complete protection, because the cash on hand at the end of the day must jibe with the total amount shown on the tape, less any amounts paid out or refunded. Refunds or paid-out transactions are handled merely by de-

pressing the "paid-out" key and indexing the necessary amount. The machine then simply lists the item instead of adding it in.

A special autographic plate located directly beneath the tape enables the cashier to make easy pencil notations, as of the name of the company to which refund was made.

Block Provides Circuit Testing in Small Space



COMPACT DOUBLE-TIER, spring-loaded terminal block provides convenient testing facilities for relay and instrument circuits in control equipment, conserving much space

L. G. WALKER
Electrical Engineer
Idaho Power Co
Boise

A NEWLY DEVELOPED double-tier terminal block with spring-loaded sockets is being used by Idaho Power Co to provide testing facilities for feeder instantaneous relays and instrument circuits on their control equipment. Its is used primarily to conserve space, but also results in a reduction in cost compared to conventional test switch installation.

The block is mounted in a location convenient to the equipment it is to serve, as shown.

Double-tier construction permits the insertion of a shorting jumper in the upper tier before removing the connecting jumpers in a current transformer secondary. Where test facilities are not provided as part of the equipment, the terminal block provides a convenient means for testing with a minimum space requirement.

Polyken®

...is my *new* name*

Everybody outgrows his britches sometime. I did it faster than most... thanks to your ever-increasing demands for Bauer & Black industrial tape.

So now I'm getting a new name... and clothes that fit. In other words, we've formed a new department with separate headquarters... under our own trade name... POLYKEN.

As new uses for industrial tapes are developed, we will continue to add specialty and standard tapes to our already broad line. And as an expanded department, we want to continue helping you in industry to speed and improve methods... cut costs.

Accordingly, Bauer & Black is pleased to announce that...

***BAUER & BLACK Industrial Adhesive Tape** will now be sold under the following trade name:

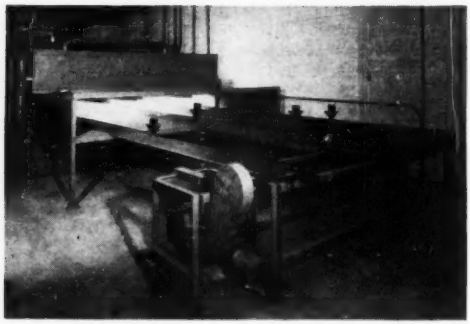
Polyken®
INDUSTRIAL TAPE

DEPARTMENT OF
BAUER & BLACK
DIVISION OF THE KENDALL COMPANY
222 W. ADAMS ST., CHICAGO 6

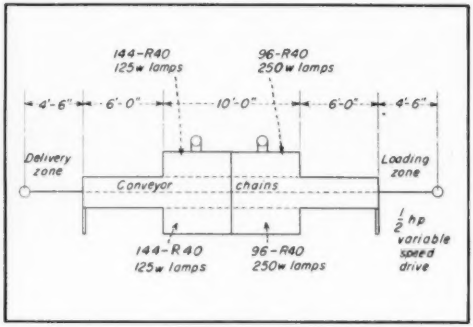
Dozens of POLYKEN tapes for hundreds of diversified jobs.

LOAD BUILDING

Infrared Lumber and Plywood Drying Proves Itself



CHAINS ARE SPACED to accommodate different lengths of boards (arrows). Boards are laid on conveyor crosswise of the chains



DRYING CHAMBER of oven, with 480 lamps, is 10 ft long by 10 ft wide in 2 connecting sections fitting nicely into assembly line

R. W. WOODCOCK
Consumers Power Co
Saginaw, Mich.

INFRARED KILN DRYING has solved a problem for Howard Industries Inc by eliminating warping and twisting of plywood and lumber which they put into the trailer coaches they build. Such warping and twisting resulted in open seams and unsatisfactory construction. The trouble was caused by improperly dried lumber.

Oven and Kiln Total 189 kw

Pleased with the results from a 105-kw infrared drying oven installed in 1947 for baking the paint finish on the trailer exteriors, the company decided to try an infrared kiln for drying lumber. Drying chamber of the kiln is 10x10 ft in two connecting sections. Number 1 section uses Type R-40, 125-w lamps arranged 16 rows wide by 9 rows long on top and bottom on 7-in. centers, a total of 288 lamps. No. 2 section contains 250-w lamps arranged on top and bottom 16 rows wide on 7 in. centers by 6 rows long on 10½-in. centers—a total of 192 lamps. Total connected heating load is 84 kw. Power for drying lamps and motors is supplied at 240 v, 3 phase, 60 cycle.

Push button control is provided on the four top and bottom lamp sections as well as for the two oven ventilating fans and the motor driving the conveyor. A push button control master switch is connected ahead of the seven control stations.

The oven conveyor is "Dual-Strand", supplied by Jensen Specialties, Inc. It consists of four chains spaced approximately 17 in., 32 in. and 49 in. to accommodate boards of different lengths. Boards are laid on the conveyor crosswise of the chains with about one inch between them. The conveyor is driven by a ½ hp motor with adjustable speed drive. Drying time desired is obtained by means of a lever-operated pulley ratio adjuster.

Lumber as received at the plant contains approximately 9% moisture but absorbs about 5% more before being used, a total of 14%. When the lumber is to be used, it is tested for total moisture content and the drying time to reduce the moisture content to about 7% is determined from experience tables. Average time under the infrared lights is approximately 20 min. Lumber used in building the trailers is usually spruce, fir or sometimes elm for the framing and gum or birch for the plywood.

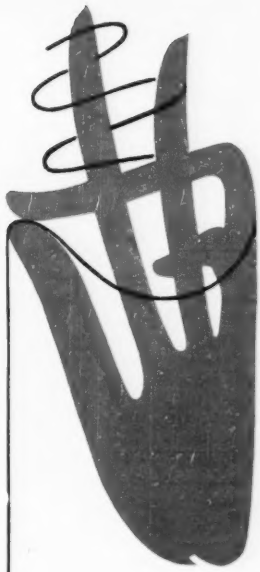
Results obtained from the operation of this infrared kiln-drying oven have been more than satisfactory. It has been possible to obtain flexibility of heat range for the desired dryness of the lumber; timing and convenience for the production line because the oven occupies a small floor space immediately adjacent; cleanliness; low maintenance; economy in operation and above all the sought-for resulting assurance that trailer coaches will not come apart at the seams after leaving the factory.

This Year Above Last in Commercial Lighting Sales

H. E. CARNEY
The Toledo Edison Co
Toledo, Ohio

OUR COMPANY was one of the first to get started in lighting sales after the war. How successful we were was told in detail in the July 31, 1948, issue of ELECTRICAL WORLD. At that time we had the feeling that the general post-war enthusiasm for improvement of commercial premises would not last too long, and that after 1948, results from commercial lighting sales efforts would begin to taper off. But the 1949 first-half record shows that this has not happened.

The accompanying comparison tables indicate that 1949 will be a



HOSKINS

Chromel

. . the original nickel-chromium heating element wire

CHROMEL resistance wire is available in B & S gauge sizes from 000 down to .0010 for a wide range of electrical heating and resistor applications.

Wherever you find an electrical heating application . . . in household appliances or in industrial processes . . . chances are you'll find durable Hoskins CHROMEL on the job. For CHROMEL, you know, is the *original* nickel-chromium resistance wire . . . the wire that *first* made electrical heating practical. It gets hot, stays hot, lasts a long time. And, for many good reasons, it's been the basic element of the industry for over 40 years. So whether your interest in electrical heating is from a utility load-building point of view, as a manufacturer of appliances, or as a user of electric heat in your production processes, be assured that your best interests are best being served by Hoskins CHROMEL resistance alloy. Complete technical information plus helpful application data is contained in our Catalog M-1 . . . want a copy?

HOSKINS MANUFACTURING COMPANY
4445 LAWTON AVE. • DETROIT 8, MICHIGAN

Comparison of Commercial Lighting Sales Results, 1948-1949

Kind of Job	Numbers of Jobs				Connected Loads—Kw	
	1949 6 months		1948 12 months		1949 6 months	1948 12 months
	All	Over 10 kw	All	Over 10 kw	6 months	12 months
New Buildings	84	20	193	45	740.44	1,832.33
Remodeled Buildings	70	42	274	38	605.18	1,411.60
Lighting Only	279	....	459	....	1,010.87	1,303.05
Totals	433	62	926	83	2,356.49	4,546.98

Comparison of Distribution of New Lighting Loads by Applications, 1948-1949

Application	Fluorescent—Kw		Filament—Kw		Neon—Kw		Totals—Kw	
	1949 6 mos.	1948 12 mos.	1949 6 mos.	1948 12 mos.	1949 6 mos.	1948 12 mos.	1949 6 mos.	1948 12 mos.
Interior	554.04	908.37	759.24	1,029.85	10.38	10.77	1,323.66	1,948.99
Office	21.70	214.22	20.45	11.85	.....	.....	42.15	226.07
Window	1.87	12.46	47.85	107.59	5.75	4.85	55.47	124.90
Sign	5.60	.55	27.95	124.37	191.23	303.87	224.78	428.79
Flood	.....	1.70	629.49	1,686.12	.....	.....	629.49	1,687.82
Miscellaneous	20.18	18.62	60.76	88.90	.....	22.89	80.94	130.41
Totals	603.39	1,155.92	1,545.74	3,048.68	207.36	342.38	2,356.49	4,546.98

little ahead of 1948 in commercial lighting sales if the second half of the year keeps up the pace set by the first—4,547 kw of new load in 1948 as against 2,356 kw in the first 6 months of 1949. In 1948, 8,173 salesman calls were made to sell 926 jobs, totalling 4,547 kw. In that year it took 8.83 calls to sell a job and each call averaged 0.49 kw of new load produced. In the first half of 1949, 433 jobs resulted from 4,627 calls, 10.7 per job. These calls produced 2,356 kw of new load, an average of 0.51 kw per call.

Thus in 1948, fewer calls were required to sell a job than in the first half of 1949, but the added load per call was a little less. Which shows that it was somewhat easier to sell commercial lighting in 1948, but that as much or more can be sold this year if you work a little harder at selling it. The market is still there.

Conforming to the Contour

Fluorescent Lighting Association

NO MAINTENANCE in the two years since installation is stated for this semi-direct oval trough fixture of cold-cathode lamps in the Quaker City Federal & Loan Association bank office, Philadelphia, Pa. The continuous, hangar mounted, unit contains 6 warm white lamps in a single line and furnishes 40 ft-c average intensity. Reflected ceiling light reduces contrast between side of the fixtures and baffles

Meters Show Boston's Cooking Costs Are Low

TYPICAL apartment range in a housing project, showing temporarily connected watt-hour meter to check monthly usage of energy. Mrs. Kenneth M. Woodland, Watertown, with four in the family including two children under 18 months, had a complete electric service bill of $8.22 for 208 kwhr, and of this the range and convenience outlet accounted for 11 kwhr, at $3.52. Tests on this and 24 other installations indicated the economic desirability of electric cooking for consideration by managers of other housing projects in the Boston area

TO ASCERTAIN by metering the relatively low cost of electric cooking in Boston Edison territory, two housing projects were studied. Under the general direction of George C. King, sales manager, Arthur B. Craig, head of the meter section, provided 25 whr meters in series with apartment-type ranges used by 12 families in one project and 13 in the other. In Framingham, Mass., the average use per range per family for the 12 families checked, was 63 kwhr per month, making the electric cooking cost about $2. In Watertown, Mass., for 13 families, the average use per range was 73 kwhr per month, and the average cost of electric cooking was $2.31 per month. In both communities the electric cooking rate was figured at 3¢ per kwhr plus a fuel charge for that month of 1/6¢ per kwhr. The 10 kwhr higher average at Watertown was attributed to a spare convenience outlet on each range, which was used for ironing and other purposes.

HOW NICHROME* "SENTRIES" IN ALLEN-BRADLEY STARTERS PROTECT ELECTRIC MOTORS

Enemy ***number one*** of electric motors is overload—excessive current that causes motor windings to overheat, burn out. Here is an enemy of ***all*** motors, small or large, ready to go into action immediately a motor starts. Devices for protecting electric motors against overload, therefore, must be exceptionally dependable . . . must not fail to disconnect the motor from the line before a dangerous temperature is reached.

FOR PRECISION-PROTECTION, ALLEN-BRADLEY OVERLOAD RELAYS EMPLOY NICHROME

In controls of this type, the current that flows through the motor windings is used to heat Nichrome thermal elements in the overload relays. Thus heating of the relay element monitors the heating of the motor windings. When a dangerous motor temperature is reached, the heat from the Nichrome unit releases a contact arm in the relay, thereby disconnecting the motor from the line. Given a few seconds to cool, the relay mechanism can be reset by pressing a button—completing the motor circuit again.

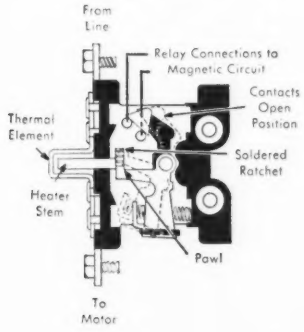
STABILITY OF NICHROME ASSURES DEPENDABLE RELAY PERFORMANCE

Because of its uniform quality, superb corrosion-resistance, and retention of physical and electrical properties at high temperatures, Nichrome is unsurpassed for the accurate job the all-important thermal unit must perform in these Allen-Bradley controls.

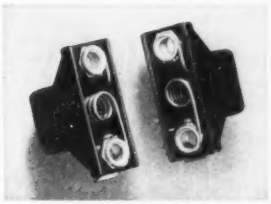
D-H ALLOYS AND YOUR REQUIREMENTS

If your products demand electrical resistance material of outstanding uniformity, high stability and long life, remember this application. Be guided by the example of Allen-Bradley and have Driver-Harris supply your needs. We fabricate the most complete line of electrical resistance alloys in the world, and will gladly make recommendations based upon your specific requirements.

ALLEN-BRADLEY RESISTO-THERM RELAY OPERATION



The heater stem is almost completely surrounded by a Nichrome thermal unit. A ratchet wheel is soldered to one end of the heater stem, and this engages a pawl which holds the relay contacts closed against spring tension. Sustained overload on the motor heats the Nichrome element which, in turn, heats the stem. Heat from the stem melts the solder, which frees the ratchet wheel. The wheel turns and releases the pawl, thereby opening the relay contacts.



TYPE N17 Thermal Unit— wound with Nichrome No. 16 B&S gauge bare wire. 3.01 amps.

TYPE N41 Thermal Unit— Nichrome No. 19 B&S gauge strip, 9/16-inch wide. 34.8 amps.

50TH YEAR — SPECIAL PURPOSE ALLOYS SINCE 1899 — D H — TRADE MARK REG. U.S. PAT. OFF. — 1899 - 1949

Nichrome is manufactured only by

Driver-Harris Company

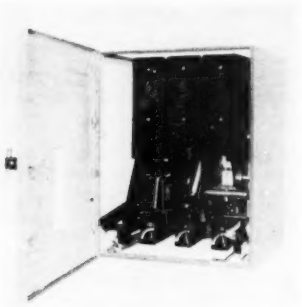
HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle

Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

*T.M. Reg.U.S.Pat.Off.

NEW EQUIPMENT



Air Circuit Breakers

AIR CIRCUIT BREAKERS are available in 15,000 and 25,000 rms amps interrupting capacity for protecting feeder circuits and for use as main circuit breakers on medium capacity systems. Continuous current carrying capacity ranges from 15 to 225 amp for the RS-15 circuit breaker, and from 35 to 600 amp for the RS-25. Potential ratings for both types are 250 v d-c and 600 v a-c. Breakers are available for manual or electrical operation utilizing Arc-Mill arc quencher and dual magnetic overload. Additional information given in Cat. 2550.

REALTY AND INDUSTRIAL CORP, ROLLER-SMITH DIV, BETHLEHEM, PA.

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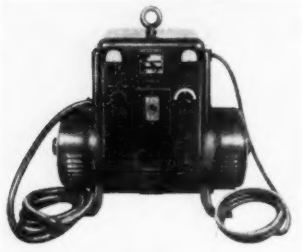

Battery Charger

A "UNIVERSAL" battery charger has been developed for charging practically any type of industrial truck battery. It is designed to charge 200 to 500 amp-hr capacity lead-acid batteries of 12, 15, 16, and 18 cells, and 150 to 450 amp-hr nickle-iron batteries comprised of 20, 24, and 30 cells.

Charge unit consists of a separately excited motor-generator set with a voltage-drop control and no-load voltage control of 30 to 60 v. The no-load voltage control is calibrated for the different cell combinations of the batteries to be charged. These controls are accomplished by the use of a carbon-pile regulator. After setting the time, the charge proceeds until the battery is automatically disconnected from the charger.

MOTOR GENERATOR CORP, HOBART SQUARE, TROY, OHIO

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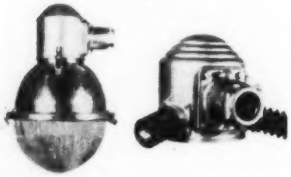


Street Luminaires

TYPES AK-10 and AK-14 street lighting luminaires feature a "universal metal head" with a new "latch-on" attachment (at right). They are interchangeable at the junction of head and reflector with similar units meeting proposed EEI-NEMA standards.

Type AK-10 (at left in illustration) is used with 2,500 to 10,000 lm lamps, and heavy-duty type AK-14, with 10,000 or 15,000 lm incandescent lamps; both can also be used with C-H5, F-H1, or E-H1 mercury-vapor lamps.

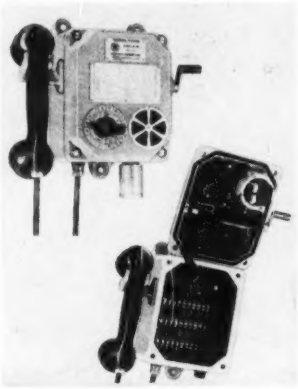
WESTINGHOUSE ELECTRIC CORP, BOX 868, PITTSBURGH 30, PA.

•

Sound Powered Phone

SOUND POWERED telephone handsets requiring no outside power are operated from the unit's 1,200-cycle magneto generator to provide 30-mi communication facilities for utilities and construction and repair crews. Each station consists of the handset mounted on an aluminum case that lifts off for wiring, a magneto, a howler unit with connecting horn for signaling, necessary terminal blocks, and a rotary selector switch for selective ringing.

Common-talking selective-ringing systems up to 24 stations, or an unlimited number of common-talking common-ringing stations, can be used per system. The heavy duty stations are weatherproof and dustproof. Stations approved by the Bureau of Mines for use in explosive atmospheres are also available.



UNITED STATES INSTRUMENT CORP, 409 BROAD ST, SUMMIT, N. J.

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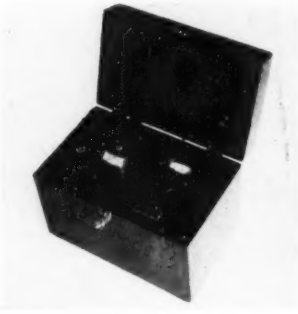


Potentiometer

DESIGNED especially for corrosion field work is a portable potentiometer with a range from 0 to 4.1 v, measurable in 1-mv steps. Standardization is said not to be affected by switching the reversing key that is used in measuring opposite polarities, or by changing to any of the 12 steps into which the range is divided.

Entire instrument, including galva-

Have you seen

THE NEW

Street Lighting Brackets

The Hubbard Round Brace Type is a graceful, one piece Bracket in which the ¾-inch diameter brace is welded to the bracket at its contact points, giving the arm unusually high strength. One piece design permits fast, efficient mounting.

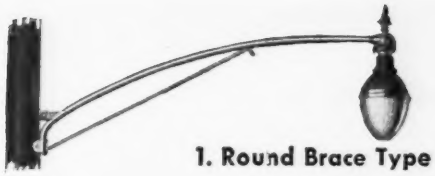
The Hubbard Tie Rod Type is a strong, rigidly supported Mast Arm made from 1¼-inch nominal Diameter Pipe. ⅜-inch diameter tie rods allow for adjustment of the arm as well as adding strength to the assembly.

Hubbard Truss Type Mast Arms are formed by welding heavy angle steel and truss plates to 1¼-inch pipe. Tie rods increase the assembly strength and permit adjustments to be made after mounting.

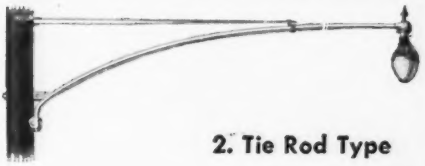
The Hubbard Municipal Type Bracket is our most popular design for Urban Areas. It is used for externally wired systems on both wood and steel poles. Municipal Brackets are easily installed by one man. The clean, modern appearance of the Municipal Type is always pleasing.

The Hubbard Universal Type Bracket is the outstanding development in the manufacture of street lighting brackets in recent years. May be used for external or internal wiring on steel poles and for external wiring on wood poles. No scroll or brace is needed because of the great strength of this design.

Hubbard Parkway Brackets are designed for internally wired steel poles. They may be mounted singly, as shown, or back to back. Brackets of this type are well adapted to modern roadway design. The rugged simplicity of their assembly reduces maintenance to a minimum.

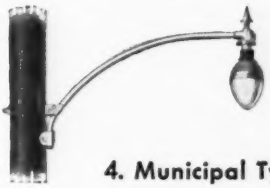


1. Round Brace Type

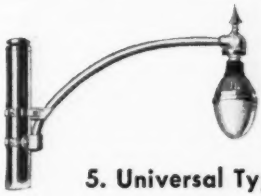


2. Tie Rod Type

3. Truss Type



4. Municipal Type



5. Universal Type

6. Parkway Type

All welded construction throughout
Requires small pole mounting space
Meet all EEI-NEMA lighting specifications
"Keyhole," basic feature of pole attachment, permits installation by one man
Simplicity of design means low cost
Permanently aligned at factory
These and other outstanding improvements found only in Hubbard Brackets and Mast Arms, covered by patents pending

HUBBARD AND COMPANY

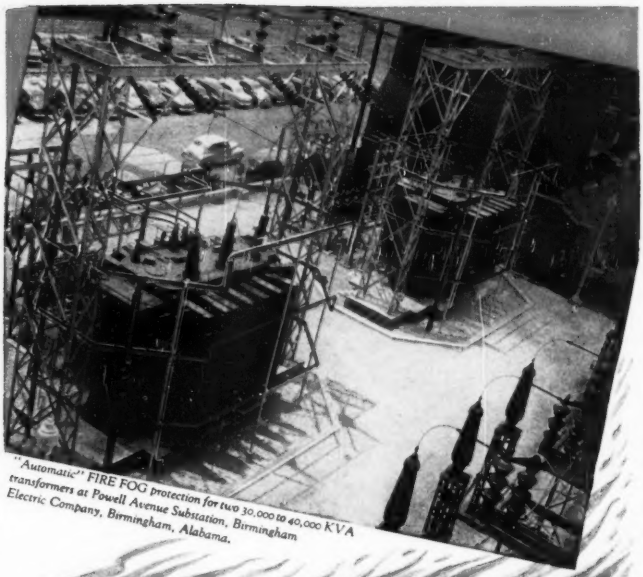
PITTSBURGH
CHICAGO

OAKLAND
CALIFORNIA

HUBBARD and Company, Advertising Dept. SL-2
6301 Butler Street, Pittsburgh 1, Pa.

Please send, to my attention, literature describing in detail the new line of Hubbard Street Lighting Brackets.

Name .....
Company .....
Title .....
City ..... State .....



"Automatic" FIRE FOG protection for two 30,000 to 40,000 KVA transformers at Powell Avenue Substation, Birmingham Electric Company, Birmingham, Alabama.

Ready, Willing and Able
TO COMBAT ELECTRICAL EQUIPMENT FIRES

Only a hint of flame at this bank of high voltage transformers and—quick as a flash, *Automatic* FIRE-FOG goes into action. From strategically positioned nozzles, a concentration of fine water spray is directed at the blaze. Flames are forced down . . . the fire area cooled. In but a matter of seconds, extinguishment is complete and damage to equipment confined only to the point of fire origin. Even out-of-service time has been held to a minimum.

Although a relatively new development, *Automatic* FIRE-FOG is widely recognized by both utility companies and private users. Designed specifically for your particular risk it is electrically safe and carries the approval of all leading insurance authorities.

More detailed information, especially as to how *Automatic* FIRE-FOG can serve your needs is available upon request and surveys and estimates will be furnished without cost or obligation. Write today.

Automatic FIRE-FOG
IT BLANKETS - IT ISOLATES - IT QUENCHES

. . . a famous member of the *"Automatic Sprinkler* Family . . . provides basic fire protection for process equipment and storage in the chemical and petroleum industries. On-the-spot protection for quench tanks, dryers, explosive hazards, conveyor openings, air filters, oil filled electrical equipment and other units vital to production line operations.

"AUTOMATIC" SPRINKLER CORP. OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler
FIRST IN FIRE PROTECTION
DEVELOPMENT . ENGINEERING MANUFACTURE . INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

nometer, standard cell, and the flashlight batteries from which it operates, weighs about 10½ lb. Binding posts are provided for connection to an external 6-v, d-c source when needed.

LEEDS AND NORTHRUP CO, 4934 STENTON AVE, PHILADELPHIA 44, PA.

•

Portable Power Supply

A 50-LB power supply is capable of providing 200-300 ma d-c for laboratory, industrial, and communications applications. Adaptable for use as either a portable or a rack-mounted unit, this Type TY-25A is adjustable between 260 and 290 v.

RCA reports that output voltage varies less than 0.5% from minimum to maximum load, with a ripple of less than 0.01% from peak-to-peak. Power requirement is 300 w, 120 v, 60 cycles.

RADIO CORP OF AMERICA, ENGINEERING PRODUCTS DEPT, CAMDEN, N. J.

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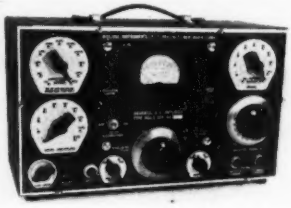


Amplifier and MVM

THE MILLIVAC type DCA-3 amplifier for direct current can be used as a vacuum tube millivoltmeter or as an

COMING
In the Next Issue

OPEN LINK CUTOUT
Construction provides greater leakage distance

DOUBLE CATHODE F LAMP
Rated at 10,000 hr with increased lumen output

POLYPHASE WATTHOUR METER
Design incorporates power factor compensation

ENGRAINED GLASS
45-deg light cut-off characteristic eliminates glare

BASIC PANEL METER
Interchangeable face plate for several ranges

"MICROHM" METER
Low resistance measurements up to 750,000 microhms

STREET LUMINAIRE LEVELER
Fixture leveled despite off-plumb bracket

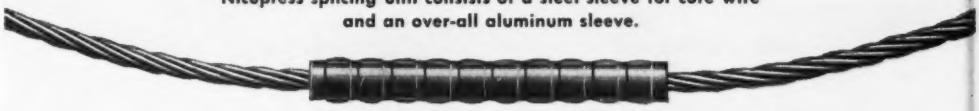
TWO-BOLT CONNECTOR
Cold forged 99.6% conductivity copper

Nicopress SLEEVES for A·C·S·R·

WILL GIVE YOU PEAK PERFORMANCE!

COMPLETED LINE SPLICE

Nicopress splicing unit consists of a steel sleeve for core wire and an over-all aluminum sleeve.



COMPLETED JUMPER SPLICE

REPAIR SLEEVE
(Partially Completed)

Nicopress is the Registered Trade Mark of The National Telephone Supply Company

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

MOSINEE

"More than Paper"

In the field of electronics and the electrical goods industry, MOSINEE is known for its *dependable uniformity*, and its scientifically controlled physical and chemical properties, such as:

Good dielectric strength . . . proper softness or stiffness . . . high tensile or tear strength . . . creped with controlled stretch or flexibility . . . specified pH for maximum-minimum acidity or alkalinity . . . accurate caliper, density, liquid repellency or absorbency.

If you have a fabricating or processing problem involving paper, a discussion with MOSINEE technicians might prove helpful. Please write Dept. EW.

MOSINEE PAPER MILLS COMPANY, MOSINEE, WIS.

"Essential Paper Manufacturers"

amplifier for external meters and recording instruments. Specific uses include: Null detection and relay operation in control circuits, direct-reading measurements and simultaneous ink recording, raising sensitivity of thermocouple measurements, and replacing galvanometers in overload protection checks.

Measuring range is between 1 mv and 1,000 v d-c. Output currents can be matched to any meter below 5 ma. Maximum sensitivity is 1 mv full scale at 6 megohms input impedance.

MILLIVAC INSTRUMENTS, Box 3027, NEW HAVEN, CONN.

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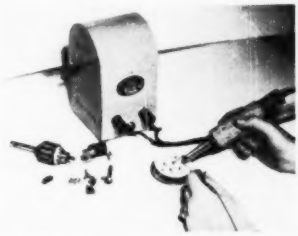

SOLDERING UNIT—Designed to handle light-weight soldering jobs, the No. 551 soldering tool is said to be heated instantaneously. Soldering electrodes $\frac{3}{32}$, $\frac{1}{8}$, or $\frac{5}{32}$ in. diam, either single or double contact type, are accommodated. The unit delivers 270 w operating from 115 or 230 v, providing capacity for two operators per unit. Unit is equipped with 6-ft cable, and weighs 17 lb.

LUMA ELECTRIC EQUIPMENT CO, 909 PROSPECT AVE, TOLEDO 1, OHIO.

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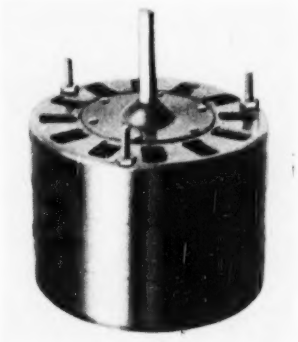


Shaded-Pole Motor

A 6-POLE MODEL shaded-pole motor, 30% efficiency, is being made in ratings from $\frac{1}{6}$ to 1/30 hp at speeds from 1,000 to 1,050 rpm when operated at rated voltage. Choke control coils permit speed reductions to 500 rpm.

A total of 1100 square feet of corrugated white translucent PLEXIGLAS *covers the entire ceiling of the elevator foyer and entrance lobby of the Central National Bank, Cleveland, Ohio. Use of 47½" x 48" x .125" sheets of the acrylic plastic results in over-all, glare-free, completely diffused illumination.*

WALL-TO-WALL LIGHTING FIXTURES OF PLEXIGLAS

Light the Whole Room Without Glare or Shadows

Customers leave their shadows at the door of Cleveland's Central National Bank. PLEXIGLAS wall-to-wall lighting fixtures in lobby and elevator foyer diffuse light so perfectly that glare and shadows simply vanish. Light-absorption is negligible, and the result is better lighting with lower electrical input.

IT'S LIGHT . . . IT'S SAFE

At the same time, the lightness and shatter-resistance of PLEXIGLAS assure safety overhead. This acrylic plastic has 7 times the impact strength of glass, yet weighs less than half as much. Large, light sections can be installed easily at reasonable cost, and because PLEXIGLAS resists discoloration—even from fluorescent lighting—maintenance expense is low.

COVERS LARGE AREAS

More and more architects are using PLEXIGLAS fixtures for superior lighting, especially over large areas in offices and public buildings. Its availability in large sheet sizes, corrugated, patterned, or smooth-surfaced—and the ease with which it can be formed into shaped panels and fixtures—permit its use in highly distinctive functional and decorative lighting.

For wall-to-wall lighting fixtures, coffer panels, reflectors, shields, cove lighting fixtures—wherever optimum illumination with no direct or reflected glare is desired—get full details of PLEXIGLAS. We'll be glad to send you complete information.

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

Canadian Distributor: Crystal Glass & Plastics, Ltd., 282 St. Helens Avenue, Toronto, Ont.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

IT'S A "RINGER"

Seelux*

for silver bowl lamps

for finest indirect lighting

lifetime beauty, efficiency

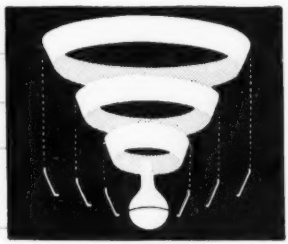
practically no maintenance

SPUN ALUMINUM LOUVRES
for distinctive modern design.

HEATPROOF ALZAK** FINISH
is not discolored or affected by lamp heat.

DUSTLESS OPEN BOTTOM
minimizes cleaning — dirt falls through.

SILVERBOWL LAMP
provides built-in reflector. Peak efficiency is *automatically* restored; when lamp is replaced, you have a new reflector.



The functional simplicity and beauty of the GUTH SEELUX make it the standout among indirect incandescent luminaires. Compare these SEELUX specs with *any* similar fixtures:

18-Gauge aluminum, emery-grained ALZAK finish. Concentric spun louvres with 25° pitch, positioned with three die-stamped 12-gauge aluminum straps riveted to each ring. Socket cover, semi-polished ALZAK; 6" canopy, stem and swivel, ALZAK aluminum; black porcelain U. L. approved lampholder.

Have you our Bulletin 840 L-H with full details on the SEELUX, SEELUX Plus and other fine GUTH Incandescent Indirects? It's yours for the asking from

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

* Ⓡ and Patents Pending
** Ⓡ and Patented, Aluminum Co. of America

Leaders in Lighting Since 1902

023

Motor is available either for stud mounting from end-cases or resilient base mounted, horizontal or vertical operation. When used with fans, ventilators, and other types of air movers, either open or enclosed housings can be supplied to meet ventilation requirements.

FASCO INDUSTRIES INC. 350 N. UNION ST. ROCHESTER 2, N. Y.

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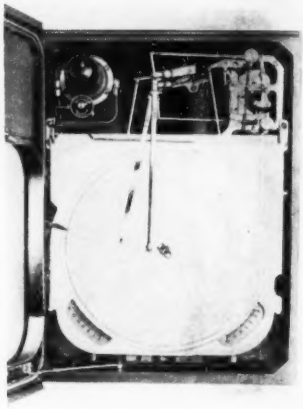


Control Instruments

AIR-OPERATED controllers for automatically controlling temperature, pressure, flow, liquid level, humidity, and pH value are available.

These Series 500 Controllers are offered in five types of control action: on-off, proportional, reset, derivative, and reset plus derivative. Instruments have only one service adjustment and are convertible from one type to another.

BRISTOL CO. WATERBURY, CONN.

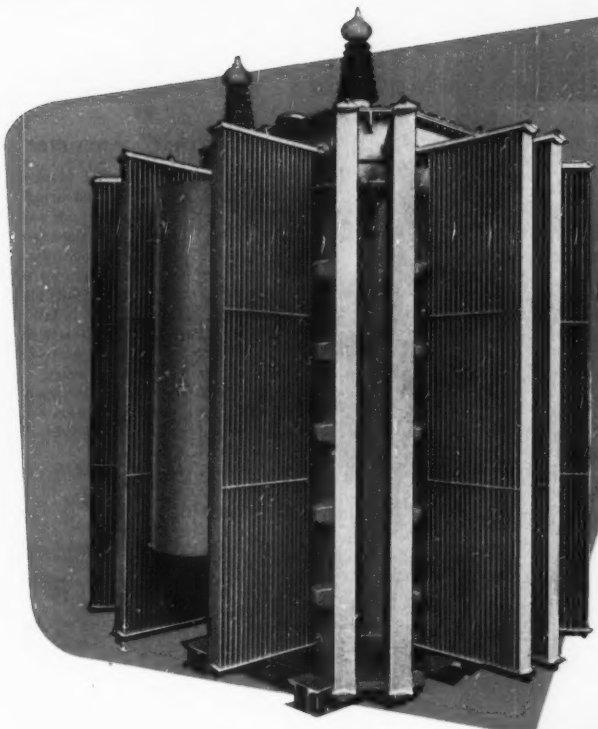
•

Microwave System

MICROWAVE RELAY equipment makes possible a system of point-to-point radio communications by a chain of radio relay stations spaced about 35 miles apart. Manufacturer claims among its features are automatic operation and lessened vulnerability to storms.

Two receivers and two transmitters are installed at each station for two-way communication. Each radio circuit is capable of carrying four conversations simultaneously by the use of channeling equipment. Each voice band can be broken into 16 signalling circuits for telemetering, signalling, or supervisory control functions.

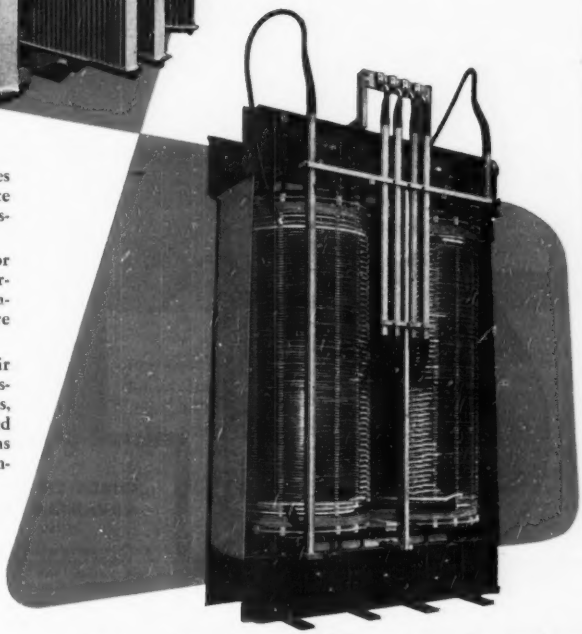
Phase modulated transmitter of this Type CWTR-5A equipment provides output of 3 w in the 940-960 mc range.



Wagner Transformers on the job . . .

16,667 kva power transformer

Single Phase, 60 Cycle
72,000 to 6,600 volts

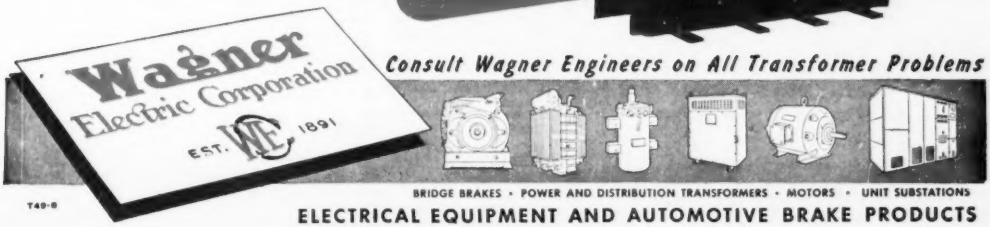


Wagner, with a background of almost six decades of transformer manufacturing, has the experience and facilities to make the building of power transformers part of the day's work.

Wagner Power Transformers are known for their *proven* dependability because they are liberally designed with extra factors of safety, constructed of carefully selected materials, and are expertly engineered, built, and tested.

Users of power transformers will find it to their interest to consult Wagner on their next transformer installation. Twenty-nine branch offices, located in principal cities and manned by trained field engineers, are ready to serve you. Bulletins TU-180 and TU-181 give information on the complete line of Wagner Transformers.

Wagner Electric Corporation
6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.



Consult Wagner Engineers on All Transformer Problems

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

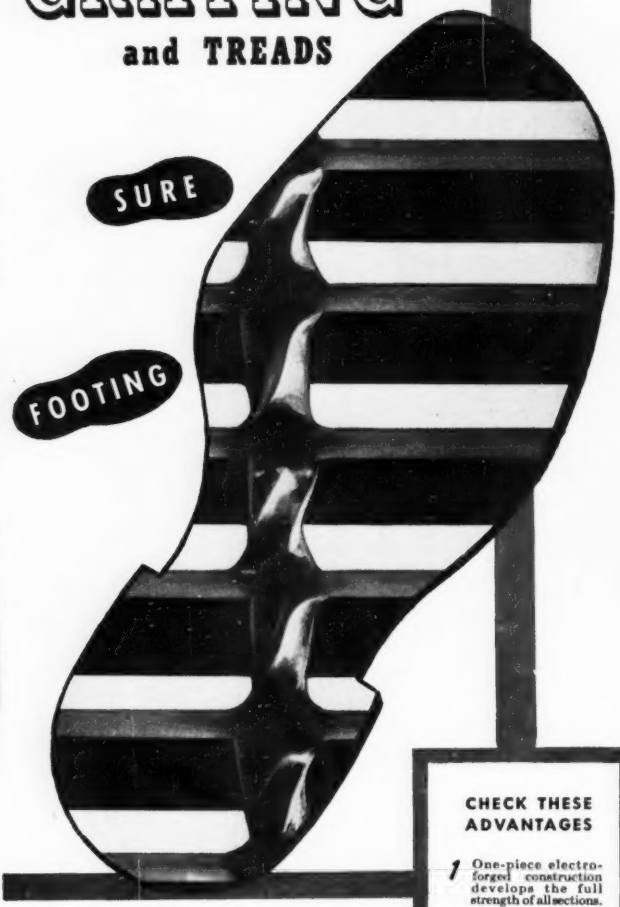
T49-B

BLAW-KNOX

ELECTROFORGED

STEEL GRATING

and TREADS



CHECK THESE ADVANTAGES

1 One-piece electroforged construction develops the full strength of all sections.

2 Maximum Open Area for light and ventilation.

3 Easy to Maintain . . . easy to paint thoroughly.

4 Self-Cleaning, no sharp angles to retain debris.

5 Safe footing at all times due to twisted cross bar.

BLAW-KNOX DIVISION

OF BLAW-KNOX COMPANY

2013 Farmers Bank Bldg., Pittsburgh 22, Pa.

• • • •

. . . So that you can have a "close-up" of Blaw-Knox Grating construction, write for a paperweight-size sample on your letterhead.

Rated power consumption is 500 w at 115 v, 60 cycles.

RADIO CORP OF AMERICA, ENGINEERING PRODUCTS DEPT, CAMDEN, N. J.

•

"Burnout-Proof" Ammeter

DELICATE METER movement is said to have been eliminated in the design of a "burnout-proof" ammeter, Model 810. No binding post connections are made; instead, the current-carrying wire is slipped through the opening in the case and a knob turned until the indicator light extinguishes to indicate that the current can be read directly off the dial. Range of meter may be changed by increasing the number of turns of wire passed through the opening. Scale range from 10-24 amp can be extended down to as low as 0.1-0.24 amp. at 60 cycles.

INDUSTRIAL DEVICES INC, 22 STATE RD, EDGEWATER, N. J.

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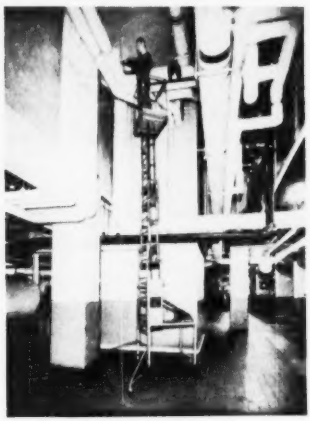


SCAFFOLD—An electrically operated extension scaffold reaches heights up to 26 ft. The welded steel safety rail is stored within a U-frame. Roller bearing swivel casters on the legs provide increased maneuverability.

ATLAS INDUSTRIAL CORP, 849 39TH ST, BROOKLYN 32, N. Y.

•

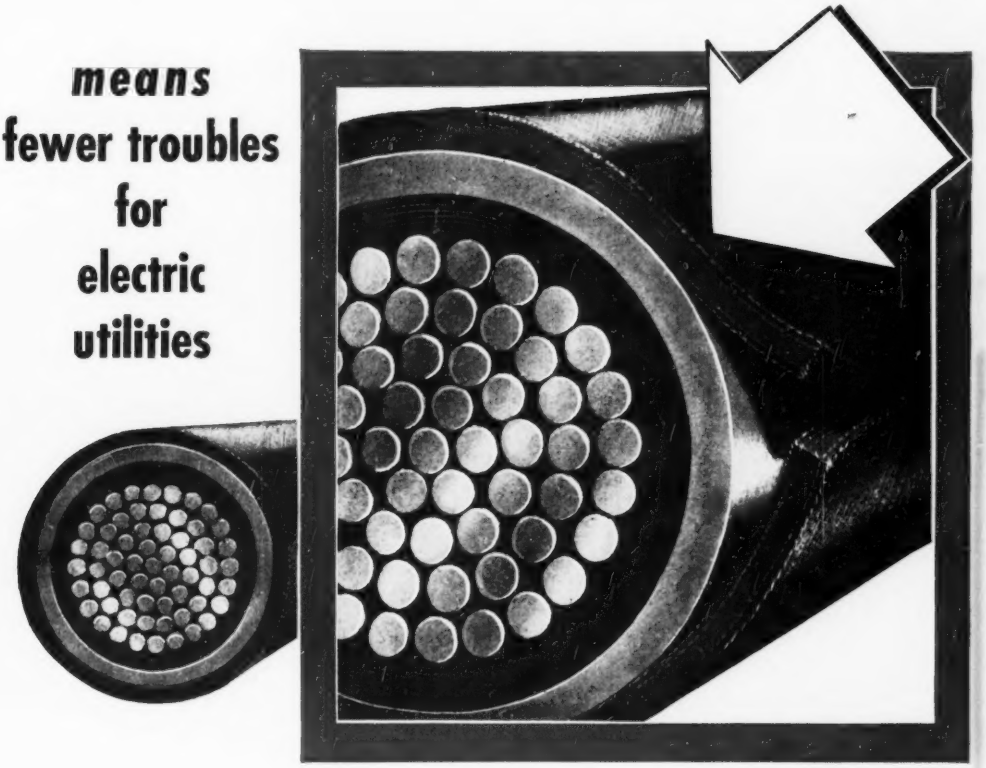
Insulating Material

VINYLITE COMPOUND VG-5911 has been listed by Underwriters' Labs as suitable for Types T and TW thermoplastic insulation and for use when exposed to oil up to 60 C. Suggested applications include power and light cable, street lighting, and general-purpose building wire.

Tentative minimum d-c resistivity is 5 x 10^6 megohm-cm at 50 C. Insulation resistivity constant at 15.6 C is 5,000, 10,000 and up. Physical properties stated

This glass-reinforced neoprene jacket

means fewer troubles for electric utilities



To prevent corrosion and to reduce the possibility of mechanical damage to underground power cables, both during and after installation, General Electric now offers a new, improved type of jacket, available on leaded cables installed in ducts, directly buried, or for aerial service.

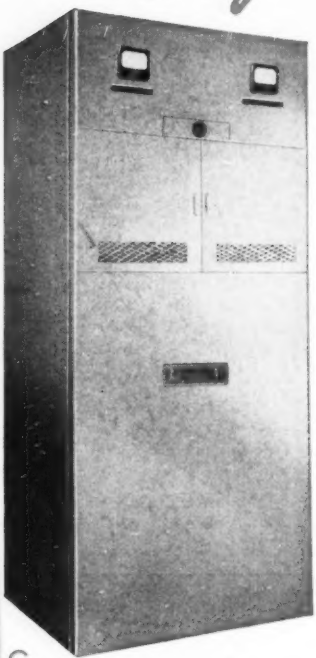
Corrosion-proof glass tape and tough, age-defying neoprene are combined in this new jacket to provide an effective defense against moisture, soil acids and alkalies, and electrolytic corrosion—to take the hard knocks and mechanical abuses that occur during installation. Composed of spiral-wrapped, permanently strong glass tapes, coated and impregnated with a neoprene compound, thoroughly bonded and vulcanized together to form a tough, homogeneous mass—this newly-designed jacket gives the protection under rugged service conditions that utilities have been seeking for years. At the same time, the use of glass tapes permits a substantial reduction in the thickness of the jacket and of the lead sheath, resulting in a reduction in weight and diameter, and easier pulling during installation.

You can have all the advantages of this new jacket on your next job. It can be furnished, at your request, on all General Electric lead-covered cables, including gas- or oil-filled cables, used by utilities. For further information, call your General Electric Construction Materials district office, or write to Section W48-1127, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

Here's a Battery Charger that is

Completely Self-Contained



- All components in one cabinet
- No separate units to install
- Cuts installation costs

Starting contactor, voltage and current controls, transformer, filter components, rectifier, meters and protective devices—all components necessary for battery charging and control are contained in the heavy sheet metal cabinet of the PECo Battery Charger . . . Compact design eliminates the necessity of installing separate starter and control panel and the interconnection of power and control circuits . . . AC input and DC output leads may be brought in from the top, simplifying conduit installation . . . There are no moving parts . . . No fans or other ventilating equipment required . . . No special foundations necessary.

Write for full information.

POWER EQUIPMENT *Company*

Specialists in Controlled Rectifiers Since 1935

55 ANTOINETTE STREET / DETROIT 2, MICHIGAN

by the manufacturer include: Stiffness at 0 C and −25 C is 20,000 and 135,000 psi, respectively; deformation measured on Randall-Stickney Gage using AWG No. 14 solid 2/64-in. wall insulation at 120 C is 15% and 32% under loads of 500 g and 1,000 g, respectively.

BAKELITE CORP, 30 E. 42ND ST, NEW YORK 17, N. Y.

MORE NEW PRODUCTS
about which you should know

GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., has announced a new 10N series of hi-surge **fuse links** in 2, 3, 5, and 8-amp ratings said to provide the same surge protection as a 10-amp universal cable-type fuse. . . . BUCHANAN ELECTRICAL PRODUCTS CORP, 1290 CENTRAL AVE, HILLSIDE, N. J., has available **splice caps** with insulators to accommodate five No. 14, three No. 12, or two No. 6 wires.

WARD LEONARD ELECTRIC CO, MOUNT VERNON, N. Y., is marketing Bulletin 35 Edgeohm high current **resistors** in four lengths from 15¾ to 6 in., which are shorter than previously listed, extending minimum resistance value per unit from 0.35 to 0.05 ohms; continuous current capacities range from 21 to 79 amp for the various sizes. . . . STEBER MFG CO, BROADVIEW, ILL., has introduced three new groups of porcelain enamel and ultranamel **reflectors**; complete line is listed in Bulletin 123.

HOBART BROTHERS CO, BOX 489, TROY, OHIO, is marketing the "Bantam Champ" d-c **arc welders.** Gasoline-engine driven Model ZXB-200-S has current range from 25 to 230 amp, 25 v, 2,200 rpm; weight is about 770 lb. . . . KATO ENGINEERING CO, MANKATO, MINN., is making a new series of **motor-generator sets**, built to order, in sizes up to 300 kw, from 15 to 400 cycles.

CALF-TERIA SALES INC, FORT WAYNE 3, IND., has a 110-v electric calf **dehorner** which requires, according to manufacturer, a 15-sec application to stop horn growth. . . . TEMPERATURE EQUIPMENT CORP, 4505 EUCLID AVE, CLEVELAND 3, OHIO, offers its EHW Formula for commercial and household use as a **protective coating** against rust, corrosion, pitting and tarnish for all metals and plated surfaces.

ACTIVE SPECIALTY CORP, ROCKVILLE CENTRE, N. Y., has introduced a line of air-cooled **lighting fixtures** known as Ventiliers which permit use of two 100-w bulbs in a relatively small fixture. . . . THE STAPLEX CO, 452 50TH ST, BROOKLYN 20, N. Y., is offering an

HOW I *Prevent Recontamination* OF INSULATING OIL

ADVANTAGES OF DE LAVAL INSULATING OIL PURIFIERS

- Dehydrates at a single pass — no re-running
- Constant high purifying efficiency — no shutdowns for cleaning or for renewal of parts during run
- Safest — continuous discharge of water prevents re-contamination of the insulating oil
- Removes water without aid of filter press; press used only to remove colloidal carbon
- Low temperature purification; high dielectric value of oil maintained longer
- Heater cannot carbonize the oil
- Higher daily capacity of purifier saves maintenance costs
- More economical to operate

"I am De Laval Centrifugal Force. In a De Laval Insulating Oil Purifier I remove water from the oil and continuously discharge the water to waste. Therefore no water can collect in the bowl of the centrifugal machine to make the Purifier suddenly ineffective. (It takes only an instant for a batch of oil in the process of purification to go from a high to a low dielectric test if it is recontaminated by water.) De Laval purification is ***safe*** and ***positive***."

When a blotter press is furnished to remove colloidal carbon from circuit breaker oil, the press is arranged in series with the Purifier so that it removes the colloidal carbon after De Laval Centrifugal Force has removed the water and other impurities.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval
INSULATING OIL PURIFIERS

7500 HOUR CHAMPION FLUORESCENT Of Course!

Ever since May, CHAMPION Fluorescent Lamps in all regular pre-heat types have been sold with a *guaranteed* rated life of 7500 hours!*

WHAT DOES THIS MEAN TO YOU?

Without costing you a single extra penny, Champion Lamps have been giving you up to triple operating value. The cost of maintenance, because of fewer lamp replacements, is much lower.

Better look into this big bargain in better light — the Champion 7500 Hour Lamp. Get in touch with your local distributor or write us for full details on this amazing Lamp value.

*On 3 hour or longer burning cycles

Here's How it adds up!

Three Times the **Life**
Three Times the **Value**
No Change in **Price**
Reduction in Maintenance

The Result — Most For Your Money When You Specify CHAMPION

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

electric **stapling machine** which staples automatically upon insertion of paper into machine; a-c and d-c 110-v models.

MICRO SWITCH, FREEPORT, ILL., has a heavy duty splash-proof spdt **switch** with "plate" type actuator said to be especially advantageous on equipment where operator safety requires two-hand control switches; rating is 15 amp, 125/250/460 v. . . . JEFFERSON ELECTRIC CO, BELLWOOD, ILL., has developed a line of narrow 30 ma **transformers** with secondary voltages of 7,500, 9,000, 12,000 and 15,000 intended for use with neon signs.

INDUSTRIAL TAPE CORP, NEW BRUNSWICK, N. J., offers a new line of Permacel electrical **tapes**; cotton tape, crepe kraft paper tape, rope-paper tape, and acetate cloth and film tapes are included. . . . MOTOROLA INC, 4545 AUGUSTA BLVD, CHICAGO 51, ILL., has a universal **control head** for use with two-way radio mobile units.

THE ELECTRIC STORAGE BATTERY CO, 19TH ST & ALLEGHENY AVE, PHILADELPHIA 32, PA., is producing a battery **cell-filler** for industrial trucks; signal lamp flashes when water in the cell reaches the proper level. . . . MILLHOUSE MFG CO, 2631 WOODWARD AVE, DETROIT, MICH., has developed a precision **grinder** with reversible a-c or d-c rheostatically controlled motor speeds from 500 to 8,000 rpm and a bevel table which adjusts and holds in all directions.

MANCO MFG CO, BRADLEY, ILL., has designed a portable hydraulic **hand tool** said to develop a cutting thrust of 22 tons and capable of cutting wire rope to 1¼ in. and mild steel rod to ¾ in. . . . EDWARD VALVES INC, ROCKWELL MFG CO, EAST CHICAGO, IND., is building forged steel instrument **valves** for providing close regulation on small lines in central power stations and boiler rooms; can be used in meters, gages, regulators and other small control equipment.

MINE SAFETY APPLIANCES CO, PITTSBURGH 8, PA., has announced a portable **ventilator** for cooling machinery preparatory to repair work, and cooling and ventilating manholes and tunnels. Canvas duct is 14 in. diam, 16 ft long; additional information in bulletin CU-2. . . . GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., is offering a portable electric **heater** with a rotating reflector; rating is 1,320 w, 120 v.

TEL-E-LECT PRODUCTS INC, 10003 MINNETONKA BLVD, MINNEAPOLIS, MINN., has announced three additions to its pole equipment line: A **winch drive box**, needing no truck clutch operation, controlled by a single lever in the cab; **derricks** of "T" and "A" types for front or rear mounting on trucks; and a steel bolt-on **cabinet** and material rack for any flat bed truck.

The PEOPLES NATURAL GAS COMPANY'S recently modernized compressor station at Brave, Pa. Building construction and equipment installation were performed by the Power Department of Dravo Corporation on a single contract basis.

DRAVO
CORPORATION

DRAVO BUILDING · PITTSBURGH 22, PA.

Engineering Constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations—fabricators and erectors of power piping—power and boiler plant equipment.

Pittsburgh, Philadelphia, Cleveland, New York, Detroit

NEWS ABOUT PEOPLE

Ingram to Head Sales for Jersey Central P&L

Edward J. Ingram has been appointed vice-president in charge of sales and commercial activities for Jersey Central Power & Light Co, Asbury Park. He succeeds Thomas R. Dobson, who died suddenly Sept 18.

EDWARD J. INGRAM

Ingram comes to Jersey Central from Reading, Pa., where he spent the past 15 years as a Metropolitan Edison Co executive, first as lighting director and later in charge of sales and related activities. Before joining Metropolitan he was with Public Service Co of Northern Illinois.

Considered an expert in the industrial and commercial lighting field, Ingram pioneered in the introduction of new applications for electricity and gas, including domestic house heating.

He founded the Better Lighting Club of Reading, which was reorganized about three years ago as the Eastern Pennsylvania chapter of the Illuminating Engineering Society. Ingram also has served as a director of IES and chairman of its finance committee and as chairman of the Pennsylvania Electric Association's commercial committee.

•

John S. Cotton, San Anselmo, Calif., consulting engineer, has been engaged by Israel to prepare a master plan and designs for irrigation and power development. The project involves conducting the waters of the Jordan River from the northern boundary to the southern end of the country for irrigation and conducting Mediterranean waters to the Dead Sea, about 400 meters lower, for power generation. The sea water would be evaporated after generating power.

•

Pullen Resigns after 40 Years with Alaska EL&P

Winfield S. Pullen, vice-president and general manager of the Alaska Electric Light & Power Co, Juneau, since 1917, has announced his resignation, to take effect next March. He will be succeeded by Franz Nagel, now his assistant.

Pullen started with the company in 1904 as a general utility man and chief electrician. He installed the first electric light plant in Sitka at the U. S. Marine Barracks in 1909 and introduced electric pipe-thawing in Juneau in 1907.

In 1912 he left the company on leave to become electrical construction superintendent for the Alaska Gastineau Gold Mining Co, which was then developing a large gold-mining property in Silver Bow Basin. He supervised the construction of transmission lines, the installation of an electric system in the mining and milling plants, and installation of of an electric railroad from the mine to the mill.

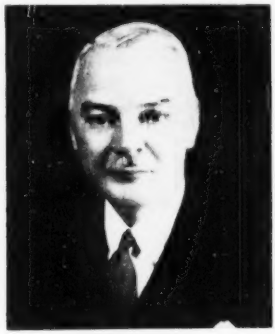
Pullen is a full member of the American Institute of Electrical Engineers and a former president of the Alaska Mining and Engineering Society.

•

C. H. Hoper, formerly city manager of Colorado Springs, has joined R. W. Beck and Associates, public utility analysts and engineers with offices in Seattle, and in Columbus, Neb. It is planned that Hoper will represent the company in Arizona, New Mexico, Colorado, and Southern states. He is well known in utility circles in the Rocky Mountain area. Before serving as city manager and manager of utilities at Colorado Springs, he held the same position at Alliance, Neb. He also has been associated with the Public Service Co of Colorado and the Bureau of Reclamation.

James D. Cunningham New ASME President

James Dalton Cunningham, president of Republic Flow Meters Co, Chicago, will take office as president of the American Society of Mechanical Engineers at the organization's annual meeting, to be held in New York, Nov 28 to Dec 2. He succeeds James M. Todd, New Orleans consulting engineer.



JAMES D. CUNNINGHAM

Albert C. Pasini, assistant superintendent of the production department, Detroit Edison Co, is one of four new regional vice-presidents.

Cunningham, who began his industrial career as a clerk for Armour Glue Works, was vice-president of Clyde Machine Works Co from 1909 to 1911. Then he left to found and become president of Steam Appliance Co, now Republic Flow Meters, manufacturers of industrial instruments and controls.

He has served as a manager and regional vice-president of ASME, of which he became a fellow in 1936. Cunningham also is a member of the Western Society of Engineers, past president of the Illinois Manufacturers Association, and a director of Autogas Co, Baltimore & Ohio Railroad Co, Belden Manufacturing Co, Lake Shore National Bank and Lumbermens Mutual Casualty Co. Public Service Co of Northern Illinois, and Allis-Chalmers Manufacturing Co.

•

George Luckey has been named assistant to the president of Public Service Co of Northern Illinois. Luckey has

In Refrigerators, too

MALLORY SILVER CONTACTS

Play a vital role in that "taken-for-granted" service

For every kind of contact material and service, Mallory is your best source.

Today refrigerators are so trouble-free that many years of service are the accepted rule. It takes a lot to offer these broad guarantees—and not the least are the Mallory Silver Contacts so many refrigerator manufacturers specify for use in temperature controls and motor starting units.

They are SURE of Mallory Quality.

For conditions requiring high electrical and heat conductivity Mallory Fine Silver Contact material is without equal.

If you require a relatively low contact resistance but greater hardness, Mallory Coin Silver is ideal. There are many other silver alloys serving a wide variety of applications.

What's Your Problem?

Mallory makes all kinds of contacts—all the way from the giant ones used at Grand Coulee to tiny thermostatic controls. Mallory's line of contacts is so comprehensive that even the most unusual problems can often be solved by a standard Mallory Contact.

But if your problem is so unique that it can't be met by an existing Mallory Contact, Mallory engineers are prepared to develop the precise contacts you need. Consult them now.

In Canada, made and sold by Johnson, Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario.

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Rectifiers
Contacts	Switches
Controls	Vibrators

Power Supplies

Resistance Welding Materials

Sleeping Peacefully

...thanks to Creosote!

THE fellow in the picture who is knocking off those solid hours of well-earned sleep is a telephone lineman. His company (lucky for him) uses poles that are pressure-*creosoted* against decay . . . that *stay* sound and serviceable. So there's small chance that pole failures will force him out into the night—when repair work is most difficult and dangerous.

Decay is the greatest threat to the strength and serviceability of wood, and creosote has established an enviable record in preventing it. Case histories show that pressure-creosoted poles—in line for over 30 years—are still capable of giving good service for some time to come.

For the best possible creosote delivery service, get in touch with Koppers—the nation's largest distributor. Koppers has 14 creosote-producing plants and 4 large storage plants. Your creosote requirements can be met promptly.

KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.

All Standard Specifications
For All Types of Wood Preservation

KOPPERS CREOSOTE...to be sure!

been with the utility for more than 21 years. He began work as a stenographer in the operating department and later served as secretary to the vice-president in charge of operations and secretary to the president. Since 1943 he has been an assistant in the office of Britton I. Budd, president.

•

GE Makes Engineering and Sales Appointments

Several staff changes have been made by General Electric Co.

V. C. Jesperson has been named sales manager in the International General Electric Co's electronics and merchandising division, where he will be responsible for sales of home appliances, radio receivers, construction materials, and chemicals. Jesperson formerly was apparatus division manager.

Two new appointments have been made in GE's Air Conditioning Department. **G. K. Iwashita,** former manager of product research, Seeger Sunbeam Corp, Evansville, Ind., has been made manager of product planning. New materials engineer of the manufacturing division is **David Rush,** who has been doing special assignment work on the manager of manufacturing's staff. Rush will direct purchasing, production and inventory control, and traffic and warehousing functions.

David A. Nisula has been appointed quality control engineer of GE's product service division. He formerly held a similar job with the home laundry equipment division at Trenton, N. J.

Three changes have been made in the recently consolidated Wiring Device and accessory equipment division of the Construction Materials department. **George S. Alcorn** will be staff assistant to G. E. Wickman, manager. **F. C. Dazley** has been appointed sales manager, wiring device sales, and **H. A. Rawson,** sales manager for accessory equipment sales.

•

Louis Ruthenburg, chairman of the board of Servel, Inc, Evansville, Ind., has been awarded the first annual award of the National Metal Trade Association for outstanding achievement in industrial relations. Ruthenburg was cited for his "energetic and accurate interpretation to his community of the rightful functions of business in developing the national economy; his pioneering in the development of foreman training methods, and contributions to the progress and technique of machine shop training and education."

Victor Emanuel has resigned as president and director of Standard Power & Light Corp because of the pressure of

ORANGEBURG
FIBRE CONDUIT

STANDARD
Installed with Concrete

NOCRETE
Installed without Concrete

On Guard Over 50 Years
UNDERGROUND

During the past 50 years—an era of great expansion for the Electrical Industry—ORANGEBURG CONDUIT has provided constant 4-way protection for the vital cables through which UTILITY COMPANIES supply the *life fluid* of modern illumination, heat and power for modern homes, offices, factories and farms. ORANGEBURG CONDUIT protects cables from . . . (1) *Cable Sheath Abrasion* . . . (2) *Pulling Tensions* . . . (3) *Corrosion* . . . (4) *Wear on Sheath* from *Cable Movement* with changing loads.

This record of 50 years underground pays tribute to the uniquely tough, strong, resistant materials of which ORANGEBURG CONDUIT is made . . . and their capacity to withstand corrosive ground waters and chemical wastes *permanently*.

Also important to UTILITY COMPANIES is the fact that ORANGEBURG CONDUIT is easy to handle, transport, install . . . low in initial and maintenance costs.

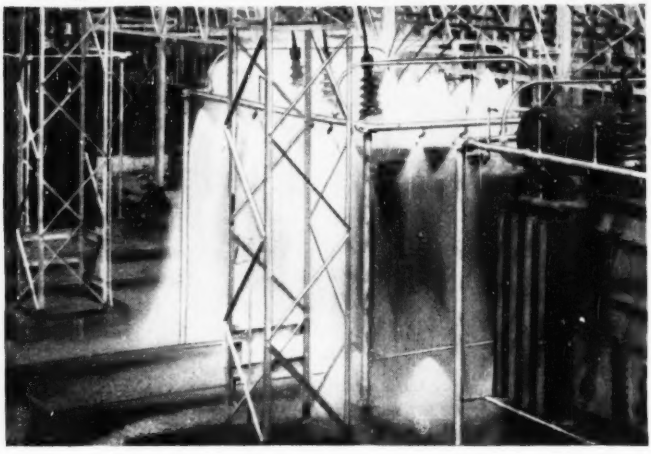
For more complete information write today for ORANGEBURG Catalog No. 50. Keep it for ready reference in your files.

ORANGEBURG STANDARD—For installation with concrete encasement.

Distributors • Graybar Electric Co., Inc.
General Electric Supply Corp.

Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

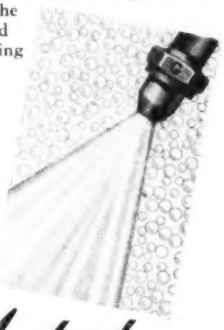
TRANSFORMER FIRES put out . . . *fast* with MULSIFYRE



When an oil fire breaks out in transformers protected by a Mulsifyre system, a battery of spray projectors puts out the fire . . . fast. Automatic, heat-actuated release devices assure quick operation. Extinguishment occurs within a few seconds after the emulsion-forming spray strikes the burning oil surface.

Mulsifyre projectors are approved by Underwriters' Laboratories, Inc. for extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard. There is no conductivity along the discharge of a Mulsifyre projector when the spray strikes conductors carrying high voltages.

Mulsifyre high-velocity projectors produce drops large enough and drive them fast enough to penetrate the flames without complete vaporization in flight, but limit their velocity so the surface of the burning liquid is agitated into an emulsion instead of passing through the oil without fire-extinguishing effect. After a period of time, the emulsion breaks down, oil and water separate, and the oil can be reclaimed.



Mulsifyre systems have proven their effectiveness during fifteen years of extinguishing transformer fires. Today they protect hundreds of installations all over the world.

For information on Mulsifyre Systems write to: Grinnell Company, Inc., Providence, R. I. Branch offices in principal cities.

GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

other business. He has been succeeded by Leo Loeb, senior partner in Loeb & Eames, utility consultants.

•

New Assignments

Dick M. Landis is the new assistant manager of De Laval Separator Co's industrial division. **Robert K. Hood** will replace Landis as manager of the industrial department of the De Laval Pacific Co . . . **Stuart Goodwillie,** until recently manager of central station sales for Sylvania Electric Products Inc, has been named manager of the company's business relations department. He also will service national lighting accounts . . . A. O. Smith Corp has made **Francis B. Dunn** manager of its Houston Works. He had been assigned temporarily to the task of building up the postwar management of the Houston Works . . . **Erling G. Fossum**, with Stewart-Warner Corp since 1926, has been appointed general manager of Stewart-Warner Electric, the company's radio and television division in Chicago. The past year he has served as assistant to the president.

OBITUARY

Raymond M. Alvord

Raymond M. Alvord, 66, retired commercial vice-president of General Electric Co's Pacific district, died at his home Oct 24 after a brief illness.

Alvord joined the testing department at GE's Schenectady Works in 1904. Two years later he was transferred to the supply department of the San Francisco office, where he became manager of the Apparatus Department's Pacific district in 1936 and commercial vice-president in 1938.

Alvord had served as director and later president of the Pacific Coast Electrical Association and as director, vice-chairman, and chairman of the lighting committee of the Pacific Coast Electrical Bureau. He was one of the organizers of the San Francisco Electrical Development League and served as its president in 1917.

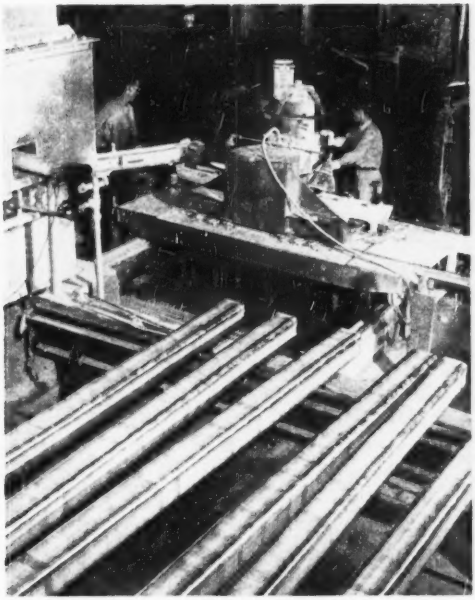
•

William J. Neal

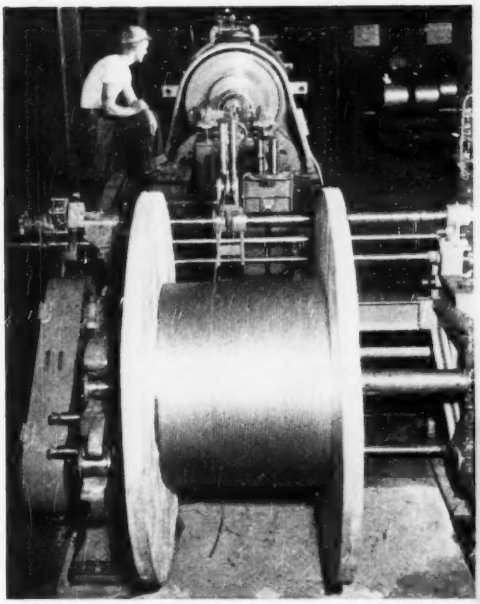
William J. Neal, 44, deputy administrator of the Rural Electrification Administration since 1943, was killed Oct 26 in an automobile crash near Las Cruces, N. M. He had been attending a convention in El Paso, Tex.

Born on the Meredith, N. H., farm which he operated until his death, Neal was in the purebred livestock business. He was active in state political and

From start... to finish...



AT PERMANENTE METALS' Newark, Ohio plant, the production of high quality Kaiser Aluminum Conductor starts in the remelt department. Here high purity pig from Permanente Metals' own reduction plants is remelted and cast into 99.5% purity ingots 6" square and 12' long. These pass through a series of automatic break-down and finishing mills to become rod ready for wire drawing.



ROD IS DRAWN into wire on the most modern equipment in the electrical conductor industry. High speed cable stranders, manned by skilled personnel, produce the finished conductor, which has been tested at every step by modern methods and equipment. Result of this completely integrated production control is pictured above —aluminum conductor of unsurpassed quality!

Controlled for quality!

As important as the high quality of Kaiser Aluminum Conductor is the consistently dependable deliveries assured by Permanente Metals' centrally located Newark, Ohio plant.

Early delivery schedules of all sizes of ACSR and all-aluminum conductor are now open. Write, wire or phone any office of Permanente Products' nationwide sales organization.

Permanente Metals

PRODUCER OF

Kaiser Aluminum

CONDUCTOR

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BUILDING, OAKLAND 12, CALIF. . . . OFFICES IN: Atlanta Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee Minneapolis • New York • Oakland • Philadelphia • Portland, Ore. • Rochester, N. Y. • Seattle • Spokane • St. Louis • Wichita

Also available through General Electric Supply Corporation, Westinghouse Electric Supply Company, and Line Material Company.

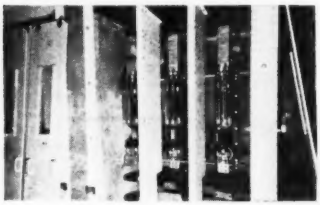
SOLVE YOUR HIGH-VOLTAGE ELECTRICAL-EQUIPMENT HOUSING PROBLEM

—with Trancell Materials

You'll find—as others have—that it is easy, fast, safe, and economical to use Johns-Manville Trancell for solving the problem of equipment housing in your station expansion program . . . and you'll find, too, that Trancell Materials make a smart, efficient-looking station.

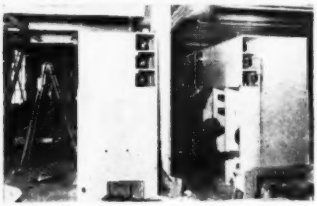
Faster to install — Trancell cuts easily, and can be quickly drilled right on the job with regular tools.

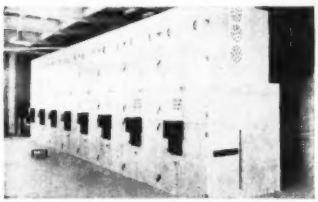
Easier to install—Trancell's light weight and strength make it easy to handle, easy to mount without framework.



Economical to install — Trancell's ease of fabrication and installation keep station expansion and future maintenance costs down.

Safer to install—Trancell is a non-metallic asbestos-base material . . . installed dry. It adequately isolates high-voltage equipment from fire and excessive heat.





Attractive when installed — Trancell makes up into neat, attractive, flush-type housings, panels, doors, and partitions that require no painting.

—for all high voltage power equipment enclosures — Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions, bus bar enclosures, and other electrical services. For further information write Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville

TRANCELL

an asbestos product for housing electrical equipment

farm-organization affairs, as master of the State Grange, as member of the New Hampshire Legislature from 1933 to 1935, and as Democratic candidate for governor in 1942. From 1939 to 1943 Neal was president of the New Hampshire Electric Cooperative, Plymouth.

William J. Neal

From the resignation of Harry Slattery in December, 1944, until appointment of Claude R. Wickard in July, 1945, he served as acting administrator of REA.

An aggressive public power advocate, Neal established a reputation for fair dealing. In REA he was credited with keeping the agency's internal operations at a high standard of efficiency and with an ability to find a solution to thorny problems. He was one of the authors REA's so-called "area coverage" policy encouraging borrower systems to serve all would-be consumers of power within their service areas.

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Charles E. Tullar

Charles E. Tullar, who retired in 1945 as vice-president of General Electric Co in charge of the patent department, died Oct 25 after a severe attack of asthma. He was 69 years old.

Tullar joined GE's patent department in 1919 and became vice-president in 1934. He also was a member of the company's engineering council and advisory committee.

His early engineering work was with St. Paul Gas Light Co; Fairbanks, Morse & Co; and the United States Treasury Department as electrical engineer and draftsman in the supervising architect's office. After joining the United States Patent Office in 1905 as assistant examiner, he was made principal examiner in charge of one of the electrical divisions in 1917.

•

John G. Stewart, 38, lighting supervisor for Ohio Edison Co, died Oct 13 in Youngstown, O.

Now...the new 3 purpose

CUSTOMER SERVICE COUNTER-DESK

Here at last is the *ideal* unit for the small one or two clerk utility office.

IT'S FIRE PROTECTED!—Designed and built to provide utmost efficiency and operating convenience *plus certified fire protection for its contents*, the Customer Service Counter-Desk combines the usual Cashier's Counter, Fire-resistive Safe and Customer Contact Desk *into one compact unit* . . . providing ample housing space for *all* Service Orders, Customer History Records, Service Location Records, Meter History and Test Data, Ledgers, Cash Coupons, Meter Books and Cash Drawer.

The 72" x 42" desk top may be used for accounting and bookkeeping operations while the counter portion provides ample space for customers to fill out applications, checks or necessary forms.

IT'S PORTABLE!—Unlike customary permanent counters, the Counter-Desk saves space and can be moved about within the office or to a new location without costly alteration charges. Resplendent in Gray-Rite finish, the Customer Service Counter-Desk will add to the appearance of any office.

For detailed information, call our nearest office or write Management Controls Division, 315 Fourth Avenue, New York 10, N. Y.

Remington Rand

THE FIRST NAME IN BUSINESS SYSTEMS

MANUFACTURERS and MARKETS

Sylvania 9-Month Profit Well Below Last Year's

Despite an upturn in incoming business in September and October, profits of Sylvania Electric Products, Inc. for the first nine months of 1949 dipped sharply from the same period a year ago.

For the nine months ended Sept 30 common stock earnings averaged $1.17 a share, compared with $2.32 for the same period last year. Consolidated net income for the third quarter was $356,530, equal to 18¢ a share. For the third quarter of 1948 it was $613,415, equal to 46¢ a share.

Net sales for the first nine months of 1949 were $73,041,240, compared with $71,735,038 a year ago. Third quarter net sales were $23,375,692; in 1948 they were $23,524,962.

Fourth quarter sales volume should be good, the company reported in a third-quarter report to stockholders. Incoming business made a strong recovery in September. Prices began to stabilize as demand quickened and are expected to remain reasonably steady at least for the balance of the year.

Lamp Sales Strong

Sales of both fluorescent and incandescent lamps, particularly the latter, have been strong all year, and shipments of Christmas tree lamps are already considerably ahead of last year's total sales. Prices of fluorescent fixtures are still weak and highly competitive; the August and September improvement in sales was less pronounced in October. Shipments have begun from Sylvania's Canadian plant.

Photoflash bulb sales are improving at a somewhat slower pace than other products because of the depressed state of the photographic market.

The industry looks for a record-breaking television fourth quarter, the report said. Demand for picture tubes, which took a sudden spurt in September, is increasing each week. This strong demand, making it necessary for manufacturers to resort to allocations again, is expected to continue well into the first quarter of 1950. Orders for the new Sylvania television sets indicate that 1949 production will be sold out before the end of the year.

JAMES COX, Duro-Test vice-president in charge of engineering, works out details of the double cathode featured in new DXC fluorescent lamp, for which a longer life is claimed

Duro-Test Fluorescent Lamp Flatters Women

"Candlelight," a new color in fluorescent lighting intended to compliment the complexion of women, has been introduced by Duro-Test Corp, North Bergen, N. J. Company engineers and Helena Rubinstein, the beauty expert, collaborated to develop the perfect combination—a light which "does the most for the skin and makeup." In the new light the blue values common to fluorescent have been depressed and the red values enhanced.

Duro-Test has also introduced an improved double-cathode fluorescent which is equipped with two extra duty cathodes on each end. Its engineers claim that this double-cathode construction provides twice the surface area and twice the amount of emission coating to insure longer life than has been possible in any previous preheat fluorescent lamp.

This new lamp, known as Duro-Test DXC, uses a new type of beryllium-free phosphor powder and is said to produce a greater lumen output on the same wattage, without premature discoloration.

Survey Indicates Need for Truck Replacement

Electric utilities will soon find it necessary to replace many of their trucks. This was indicated by a flash survey of eight representative companies in different sections of the country. The companies told ELECTRICAL WORLD that between 25% and 33% of their truck fleets are prewar.

If these companies are typical, the national utility truck fleet has been increased by about one third since the war. The eight reporting, which operate 3,366 trucks, have added 973 units to their fleets since 1945. But they reported 903 prewar units still in use.

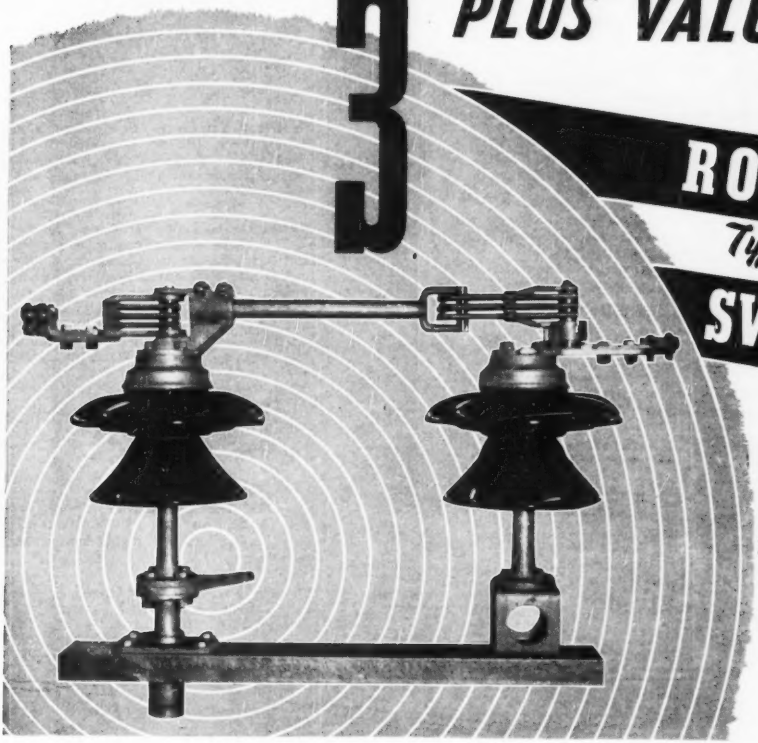
The companies surveyed had a total 1948 operating revenue of $365,616,060, about 8% of the industry, and a capacity of 3,569,932 kw, about 7% of the total. Their total investment in transportation equipment, including passenger cars, was $9,798,086.

Projection of these company figures to cover the entire industry has its hazards because of wide geographical variations in transportation requirements. However, such a projection, for whatever it is worth, would indicate a total fleet of between 55,000 and 65,000 trucks and an investment of about $125 million in motor vehicles of all types.

Manufacturers of trucks indicate that supply is ample.

3 PLUS VALUES OF

ROYAL Type RLL SWITCHES



1 SIMPLICITY OF DESIGN

*2 HIGH PRESSURE POINT CONTACTS

3 SEALED BALL BEARINGS

•

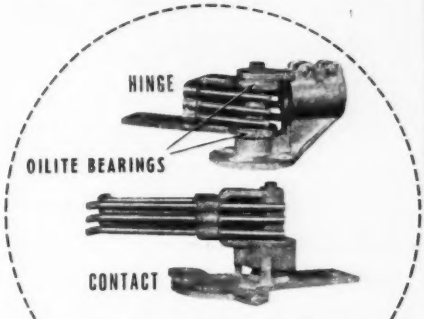
* HIGH PRESSURE POINT CONTACTS:

Both front and rear contacts of Royal's type RLL switch utilize the now popularly accepted high pressure point contacts of a patented design which has been in production at Royal since 1937. Contact pressure is developed by expanding the contact rods across the long axis of the blade cam. This permits opening and closing of the switch by a simple direct movement of the blade, without any supplementary mechanisms. The same type contact is used at the hinge.

Royal pioneered the elimination of braid shunts at the hinge end. This feature assures service continuity even after years of operation in highly contaminated atmospheres. The front contact is held in position to receive the blade by a beryllium-copper motor spring. At the hinge end a point contact pressure of 75 lbs. is maintained, and yet there is sufficient freedom of movement for an unsupported 3-ft. length of No. 2 three-strand wire to prevent the hinged terminal from following the blade movement. These switches are extremely simple, easy to operate and easy to maintain.

The Royal Type RL switch listed on pages 158, 159, 169 and 170 of Catalog No. 11 is a center rotating double break design incorporating these same mechanical and electrical features.

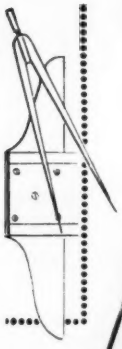
A copy of this catalog will be sent to you upon request.



HIGH PRESSURE POINT CONTACTS AT HINGE AND CONTACT ENDS

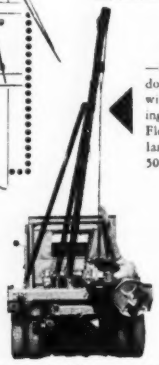
35 YEARS
A Part of the Arsenal of
AMERICAN POWER PRODUCTION

Royal ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET *Chicago 19, Ill.*
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices



Designed to meet your needs...
PRECISION BUILT
POLE DERRICKS

Available in both steel and light weight aluminum models



T-TYPE POLE DERRICK

—handles wide range of work. Operates with double drum winch. Derrick head equipped with special cable guide rollers to avoid fraying or shearing cable —increases cable life. Flexible — adapted to trucks 1½ tons and larger. Lift — approx. 22 ft.; handles poles 30 to 55 ft. length.

TRIPOD TYPE DERRICKS

—handle wide range of lifts with ease and rigidity. Telescoping side-legs available for all models at slight extra cost. Derrick head equipped with roller guides for cable protection and long cable service life. Available in 4 models: handling poles 35 to 70 ft. lifting capacity up to 13,000 lbs. with stiff-leg in ground position.

FWD pole derricks are precision built to provide the utmost in safety and service. For complete information on derricks and other FWD line construction and maintenance equipment send for catalog.

EAGLE MANUFACTURING CO.

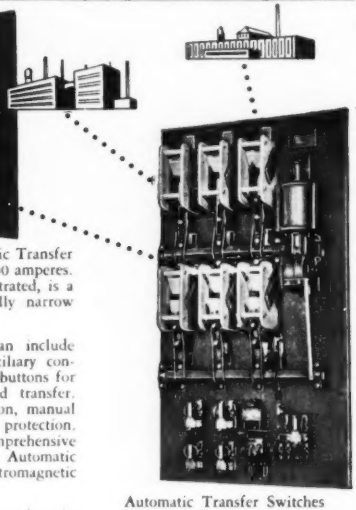
Division of the Four Wheel Drive Auto Co.

APPLETON WISCONSIN

Write today for the complete catalog of FWD Line Construction and Maintenance Equipment — a useful reference book.

HEADQUARTERS FOR

AUTOMATIC TRANSFER SWITCHES



We can take care of almost any Automatic Transfer Switch requirement ranging from 5 to 1000 amperes. For example, Bulletin 906-105S, as illustrated, is a 300 ampere unit installed in a specially narrow panel for a distribution control center.

Standard features on control panels can include phase failure protection, indicating auxiliary contacts, engine starting contacts and push buttons for engine tests, reset to normal and load transfer. Special features include delayed operation, manual emergency handles, low frequency relay protection. Condensed Catalog No. 700 gives a comprehensive picture of our work along the line of Automatic Transfer Switches and complete Electromagnetic Control Panels.

If you require any type of automatic control, write us. Our 60 odd years of broad experience in the field of Electromagnetic Controls should be helpful.

Automatic Transfer Switches
Remote Control Switches
Contactors Relays
Specialized Electromagnetic Controls

We also manufacture a complete line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases.

ASCO Electro-Magnetic CONTROLS

Automatic Switch Co.

397 LAKESIDE AVENUE · ORANGE, NEW JERSEY

New Sales Assignments

Electrical manufacturing companies have appointed the following sales representatives:

Electrical Engineers Equipment Co, Melrose Park, Ill., has appointed W. J. O'Brien, 1611 Exchange Bldg, Memphis, Tenn., to represent it in Arkansas and Tennessee.

Westinghouse Lamp Division, Bloomfield, N. J., has established a new sales district for the greater Chicago area, embracing nine counties in Illinois and four in Indiana. Andrew G. Nelsen is manager. Adolph Frankel will succeed him as manager of the Northwestern District, covering nine states and parts of two others. Both men make their headquarters at 20 N. Wacker Drive, Chicago.

Gibson Electric Co, Pittsburgh, has appointed John D. Tebeen & Co, 20869 Mound Road, Detroit, as sales representative for Michigan and Toledo.

USCO Power Equipment Corp, Birmingham, Ala., has appointed as its agent for New England and the bulk of New York State S. W. Stockwell, Route 2, Concord, N. H.

Electric Products Co, Cleveland, has made J. R. Williams district manager of its Chicago office. His district includes 19 counties in northern Illinois, all of Indiana, Iowa, Minnesota, and Wisconsin, and most of the upper peninsula of Michigan.

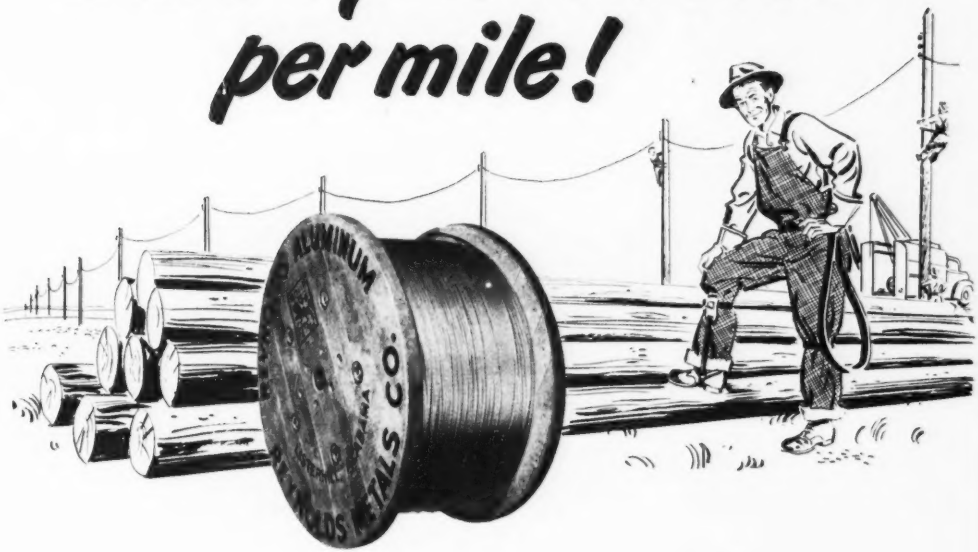
Pyle-National Co's multi-vent division, Chicago, has appointed 10 additional manufacturer's representatives. They are J. P. Ashcraft Co, 2826 Fondren Drive, Dallas; R. M. Brand Co, Tucson, Ariz.; Joseph P. Maguire, 615 Commercial Place, New Orleans; E. H. Norton, 616 Loyd Building, Seattle; Pacific Scientific Co, 1430 Grande Vista Ave, Los Angeles; J. Arch Colbrunn, 1605 McLemore Ave, Memphis; Francis J. Fallquist, 507 Kuhn Building, Spokane; Thomas E. Price, 11 Oak Court, Houston, Tex.; Northwest Furnace Supply Co, 911 Northwest Hoyt St, Portland, Ore., and S. C. Pardee, Sharon Building, San Francisco.

Cannon Electric Development Co., Los Angeles, has appointed O. F. Masin, 17 East 42nd St, New York City, to represent the company's multi-contact connector lines in the New York area. The firm will cover these items in the New York counties south of and including Ulster, Duchess, and Sullivan and New Jersey counties from Burlington north. H. M. Linter will continue to represent Cannon Electric in the same area for power plugs, signal equipment, and other electrical specialties.

Colonial Electric Products Co, East Paterson, N. J. has named Juan Martinez Vela, Inc, San Juan, Puerto Rico, as its Puerto Rican distributor.

The States Co, Hartford, Conn., has appointed Arthur E. Booth Co, 4124 Beverly Boulevard, Los Angeles 4, to serve southern California and James W. Carroll, P. O. Box 332, Charlotte, N. C., to serve North and South Carolina.

Save up to 4 Poles per mile!



WITH LIGHTER, STRONGER REYNOLDS ACSR

THAT'S right—you can save the price of four poles per mile plus handling and setting costs with the use of Reynolds ACSR. The reason—this high strength yet lightweight aluminum conductor permits greater spans without increase in sag.

Now, add the economies resulting from easier, faster stringing of this lightweight aluminum conductor. Power lines find their way into some mighty rough country. Men and equipment are handling 20% less weight when you specify ACSR.

And the best part of it is that these are just "extra dividends". The initial cost of Reynolds ACSR is considerably lower than copper so you make a major saving the moment you switch to aluminum.

Reynolds will welcome an opportunity to quote you on your cable needs. For prices and complete product data, call the Reynolds field office listed under "Aluminum" in your classified telephone directory.

VALUABLE MANUAL FOR ENGINEERS

Sag-tension charts, staking tables, stringing-sag tables, data on line design and erection—this and other valuable data are contained in this complete manual. Free when requested by letter. Write to Reynolds Metals Company, Louisville 1, Kentucky.

REYNOLDS METALS

REYNOLDS *Lifetime* ALUMINUM

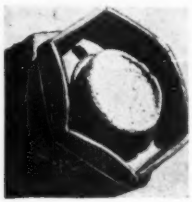
CONSIDER ALUMINUM • CONSULT REYNOLDS • THE COMPLETE ALUMINUM SERVICE

Truscon equips world's tallest radio tower *with*

PALNUT
TRADEMARK

SELF-LOCKING NUTS

This new 1220-foot Truscon Radio Tower, tallest ground-supported tower ever built, incorporates many advanced engineering specifications. But one important specification remains unchanged . . . the use of PALNUT Self-Locking Nuts . . . continuing a 15-year standardization by the Truscon Steel Company, Youngstown, Ohio for all its towers.



- Prevents loosening of regular nut and bolt.
- Eliminates checking and retightening of bolts.

FOR years PALNUT Self-Locking Nuts have been standard equipment on towers built for AM, FM, TV, Signal Corps, power transmission, etc. Low in cost, easily applied on top of regular nuts. PALNUTS provide absolute assurance against loosening of bolted assemblies. No further maintenance is required. PALNUTS have proved superior to lockwashers or prick punching.

Specify PALNUTS for your towers. Available in a wide range of sizes, hot dip galvanized for weather resistance. Ask for samples and literature.

The PALNUT Co.
51 CORDIER ST. IRVINGTON 11, N. J.

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shiping point or f.o.b. cars at Yuma, Ariz., switchgear assembly, and circuit breaker for Wellton-Mohawk Pumping Plants 1, 2, and 3, Wellton-Mohawk Div., Gila Proj., Spec. 2817. L. N. McClellan, ch. engr.

Conn., Berlin — Connecticut Light & Power Co., 36 Pearl St., Hartford, plans by Douglas Orr, 96 Grove St., New Haven, 60,000 sq. ft. brick, steel office, Webster Rd., Approx. **$250,000.**

Georgia—Jackson Electric Membership Corp., Jefferson, rural distr. lines. Plans deposit $25. Patterson & DeWar, Rutland Blvd., Decatur, engrs.

Ga., Alamo—The Little Ocmulgee Electric Membership Corp., Alamo, warehouse and office, Approx. $68,000. Plans deposit $25. Southern Eng. Co., 699 Spring St. N.W., Atlanta, archts.

La., Monroe—Contr. 5, removal boilers, boiler foundations and boiler room floor and installing new boiler foundation boiler room floors for municipal power plant, Ford, Bacon & Davis Constr. Corp., 39 Broadway, New York, N. Y., engrs.

Md., Owing Mills—State of Maryland, Dpt. P. Imprvts., 200 W. Franklin St., Baltimore, power house and underground utilities, Rosewood State Training School, $1,500,000. Plans deposit $10. Elser & Akers, 916 N. Charles St., Baltimore, engrs.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1 A, Denver Federal Center, Denver, Colo., 3 outdoor power transformers, Canyon Ferry Power Plant, Louisville, Missouri River Basin Proj., Spec. 2816. L. N. McClellan, ch. engr.

Montana—Bureau Reclamation, Dpt. Interior, Billings, 1 transformer, 1 automatic service restorer, 1 horngap switch, 1 set disconnecting and by-pass switches, 3 disconnecting fuses, 1 fuse cutout, 1 combination hookstick and fuse remover, 3 lightning arresters, 3 current and 3 potential transformers, 1 cabinet enclosing recording-demand meter, watt-hour meter, and 1 circuit breakers for Buford-Trenton substation, Fort Peck, Proj. (Region 6), Spec. R6-Bil-5, L. N. McClellan, Bldg. 1A, Denver Federal Center, Denver, Colo., ch. engr.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Louisville, three 23,500 hp. hydraulic turbines for Canyon Ferry Power Plant, Canyon Ferry Unit, Missouri River Basin Proj. Spec. 2814.

Neb., Bellevue — Loup River Public Power Dist., Columbus, power station exten., incl. substructure for Unit 3, Part of $2,000,000 addn'l. proj. Sargent & Lundy, 140 S. Dearborn St., Chicago, Ill., engrs.

N. Y., Long Island City—National Sugar Refining Co., 2-03 55 Ave., power plant addn.

Oregon—Bonneville Power Admin., 729 N. E. Oregon St., Portland, clearing 8.16 mi. right-of-way for Coos River-Coos Bay sect. of Reedsport-Coos Bay 115 kv. transmission line, Coos Co., Inv. 4861. Plans deposit $5.

Pa., Erie—Pennsylvania Electric Co., D. W. Jardine, pres., 21 W. 10 St., Front St. Station addn., incl. installation 2 turbogenerators and 2 high pressure boilers increasing present capacity from 62,000 to 126,000 kw. **$12,500,000.**

Texas—Patricio Electric Co-operative, Sinton, rural distr. lines, San Patricio Co. **$350,000.**

Va., Petersburg — State of Virginia, Richmond, power plant at Central State Hospital for Negro mentally ill patients, water treatment plant and sewer line included. **$496,839.**

100% Visibility When You Employ Binkley Guy Guards

Yes, 100% visibility insures the utmost in protection and appearance to your guy lines and poles. Maximum flexibility and ease of attachment are paramount with BINKLEY Guy Guards.

Two Types—Half Round and Tapered Round 7' and 8' lengths

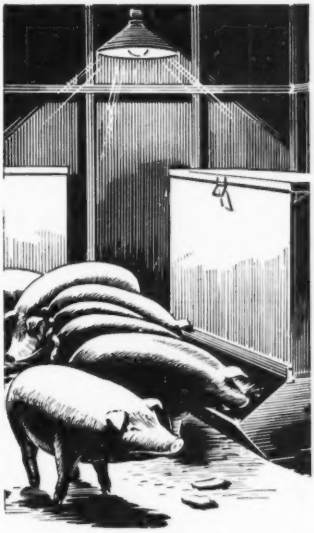
WE INVITE YOUR INQUIRIES —NEW LOW PRICES

Binkley
MANUFACTURING CO.
WARRENTON, MO.

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA



Midnight snack that pays off in pork chops

FEED hogs at midnight?—One farmer does, and finds it pays. He fills troughs, then wakens swine with floodlights. Soon they are greedily enjoying their "snack." When lights go out, the animals retire—to grow pork chops while they sleep! Odd?—Perhaps; but this is one more example of the uses for electricity on the farm!

With rural electrification, comes the need for efficient pole-line insulation. Hemingray Power Insulators have answered this need with complete dependability.

No. 680 for 15,000 volt lines. The technical standards committee of the Rural Electrification Administration has approved Hemingray Insulators No. 670, No. 680 and No. 514 under the limits of AIEE Specification No. 41-1944 for use on REA lines.

HEMINGRAY
POWER INSULATORS

American Structural Products Company
Muncie, Indiana
Subsidiary of Owens-Illinois Glass Company

WATER PUMP PLIERS
A slip-joint design permits four jaw adjustment... extra length handles give added leverage.
LINEMAN PLIERS with HANDLEGRIP
Powerfully built cutting pliers... shown with plastic insulating grips ... guaranteed shock protection against average voltage.
Vacuum Grip
PLIERS
An Exclusive Snap-on Product
will far outlast ordinary brands!
1. Hammer forged from special high carbon Silco-Molybdenum alloy steel.
2. Hardened with liquid heat and oil tempered clear through—not surface hardening only. Joints locally tempered electrically.
3. Scientific design which distributes strain over entire tool assuring maximum strength.
4. Smooth, perfectly matched, easy riding precision machined joints.
5. Sharp, deep milled teeth giving intense gripping power.
6. Hand filed, perfectly aligned blades on all cutters.
7. Spring tempered Vacuum-Grip "Non-Slip" handles.
25 patterns. Available only through Snap-on's nationwide, direct-to-user tool service .... not at any hardware or mill supply stores.
HEAVY DUTY COMBINATION PLIERS
A popular favorite with automotive mechanics, combining powerful cutters with tremendous gripping strength.
DIAGONAL CUTTERS
Finest diagonal cutter made... hand filed, perfectly matched cutter jaws. Recommended for cotter pins and tough cutting jobs.
NEEDLE NOSE PLIERS
Despite the slender nose they are extremely rugged. Specially machined for wobble-free action.
Snap-on Tools
THE CHOICE OF BETTER MECHANICS

SNAP-ON TOOLS CORPORATION

8108-J 28th Avenue
Kenosha, Wisconsin

ASK US ABOUT
GATES & GATE HOISTS

Murray Gate Hoists are designed and built to meet all requirements . . . from the smallest hand operated to large motor operated—a wide range of capacities from less than 1 ton to over 100 tons. During our nearly half a century of designing and building gate hoists we have developed various designs for the different types of gate hoist problems. We feel sure we have designs and patterns that will fit your requirements.

We also build gate hoists entirely from your plans and specifications, if desired. In planning gates or gate hoists it is suggested you communicate with us before your plans for the project as a whole are completed . . . it will save expense and much preparation time.

Our engineering department is at your service, any time, to help solve problems involving the type of equipment.

D. J. MURRAY MANUFACTURING CO.
WAUSAU WISCONSIN

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
RMC
FROM STOCK

Write for a complete selection of RUSGREEN bulletins

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

Low Bidders & Contracts Awarded

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Oct. 20, approx. 70 mi. Brush-Limon 115-kv transmission line, Colorado-Big Thompson Project, Spec. 2792, Schedule 1, aluminum conductor, from J & J Constr. Co., 1 Natl. Bldg., Oklahoma City, Okla., **$409,472**; Schedule 2, stranded copper conductor and Schedule 3, copperwelded-Copper conductor, from Walco Eng. & Constr. Co., 2408 E. 4 Place, Tulsa, Okla., **$543,380** and **$586,376** respectively.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., Oct. 18, Yuma-Wray 69-kv transmission line, Colorado-Big Thompson Proj., Spec. 2786, Schedule (1), aluminum conductor, from Utilities Constr. Co., Exchange Bldg., Nashville, Tenn., **$131,140**; ***Schedule 2, stranded copper conductor from Lake Electric Co., Devils Lake, N. C., **$167,194**; ***Schedule 3, copperweld-copper conductor, from J. R. Foree Natl. Bank of Topeka Bldg., Topeka, Kan., **$149,704.**

Ia., Cedar Falls—City, City Hall, bldg. and mechanical work, power plant sys. and imprvs., to Winger Constr. Co., Ottumwa, **$208,428.**

Minnesota—Rural Co-operative Power Assn., Milaca, Oct. 18, 73 mi. rural distr. lines, etc., Minn., to Hennepin, from W. A. Patterson Co., 1816 Selby Ave., St. Paul, **$118,144.**

N. Y., New York—Bd. Transportation, 250 Hudson St., Zone 17, Oct. 7, furnishing, installing D. C. connections, track bonding and associated work for Pelham Line, Hunts Point Ave. to Pelham Bay Park, Bronx Boro, from Jandous Electric Constr. Corp., 210 E. 40 St., Zone 16, **$128,500.**

Oklahoma—U. S. Eng., P. O. Box No. 61, Tulsa, two 17,895 k.v. generators for Tenkiller Dam, Illinois River, CIVENG-34-066-50-8, to Elliott Co., Ridgeway, Pa., **$864,719.** Est. $850,000. Bids 9/8, awarded 10/11.

Tennessee—Cumberland Electric Membership Corp., Clarksville, 210 mi. rural distr. lines, Stewart, Montgomery, Cheatham and Dickson Counties, to Utilities Constr. Co., 151 4 Ave., N. Nashville, **$254,878.** Bids 10/20.

Tex., Galveston—Medical Branch, University of Texas, 104 Main Bldg., University of Texas, Austin, Oct. 19, electric wiring sys., from Pfeiler Electric Co., LaPorte, **$171,898.**

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Proposed Construction

Calif., Los Angeles—Hotel Statler Corp., Pennsylvania Hotel, 7 Ave. and 33 St., New York, N. Y., plans by Holabird, Root & Burgee, 333 N. Michigan Ave., Chicago, Ill. 13 story hotel and office bldg., 900 to 948 Wilshire Blvd. **$10,000,000.** Steve B. Barnes, Robert S. Kadow, Mark F. Deering, 809 W. 3 St., Los Angeles, consult. engrs.

La., New Orleans—Hilton Hotels Corp., 5 Ave. and 59 St., New York, N. Y., hotel. Approx. **$4,000,000.**

Mass., Brookline—New England Deaconess Hospital, Pilgrim Rd., plans by Coolidge-Shepley-Bulfinch-Abbott, 1 Court St., Boston, Central Hospital. Approx. **$3,000,000.**

N. Y., New York—161 Williams St. Corp., Samuel Friedenberg, pres., c/o Sylvan Bien, archt., 565 Fifth Ave., 21 story office, William and Ann Sts., **$2,600,000.**

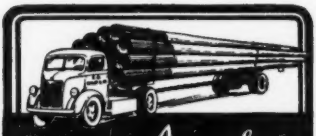
O., Dayton—Dayton University, Rev. George J. Renneker, pres., 300 College Pk., 15 bldgs. for Dayton University, **$15,000,000.**

O., Lorain—Metropolitan Housing Auth., City Hall, housing, incl. 650 housing units. **$5,000,000.** Lewis Goodell, city engr.

Low Bidders & Contracts Awarded

Ala., Montgomery—Allen N. Smith, c/o contractor, 250 apartment units, to Algernon Blair, 1 Natl. Bank Bldg., Approx. **$1,000,000.**

D. C., Wash.—Ian Woodner, Ring Bldg., constr. Rock Creek Plaza Apartments, 3636 Sixteenth St. N.W., to Jonathan Woodner Co., 12000 18 St. N.W., **$5,000,000.** Wallace F. Holladay, 1116 S. Thomas St., Arlington, Va., archt.



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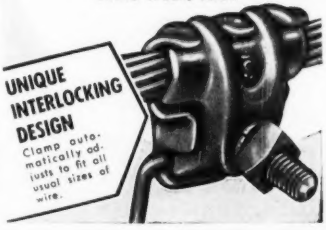

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RECENT RATE CHANGES

Arizona Edison Co has reduced power rates to residential consumers in the Coolidge area. The cut, amounting to nearly 40% in certain categories, was made possible by a new contract with the U. S. Indian Service, which sells power to the firm in the Coolidge area. New rates are 5.25¢ a kwhr for the first 30 kwhr used each month; 3.5¢ for the next 40 kwhr, 2.5¢ for the next 200, and 1.25¢ for all over 400.

Lake Worth, Fla., City Commission has passed a new electric rate schedule providing for lower rates for larger consumption, effective the first meter reading after Nov 15. The new schedule will cut annual revenues about $15,000, based on present consumption. The domestic rate minimum also was reduced from $3 to $1.50.

MANUFACTURING BRIEFS

"Inventory allergy" threatens to cost retail and wholesale housewares merchants from one half to one billion dollars during the next three months, according to J. W. Alsdorf, president of Cory Corp of Chicago and president of the National Housewares Manufacturers Association. He warned wholesalers and retailers not to be caught with empty shelves during the October-November-December sales season, when the small appliance industry does approximately 50% of its total annual business. Wholesale orders upon which fall and winter inventory is based have been between 25% and 50% off from 1948 levels, and backlog stocks have been almost completely reduced.

Television today means more to the electrical industry than any business to emerge in the past two decades, Joseph B. Elliott, vice-president in charge of RCA Victor Consumer Products, told the fourteenth annual conference of the International Association of Electrical Leagues. Even though it costs the consumer only about 2/5 of a cent to operate his receiver, the popularity of the medium could well mean $18.5 million additional revenue for the nation's electric utilities, he said.

September factory sales of vacuum cleaners were third largest of any month in 1949. The 247,036 total was an increase of 12.3% over August's 219,909 but 10.5% below September, 1948, when 276,137 units were sold. For the first nine months of 1949 vacuum cleaner sales totaled 2,091,935, or 17.8% below the 2,546,269 sold in the like 1948 period.

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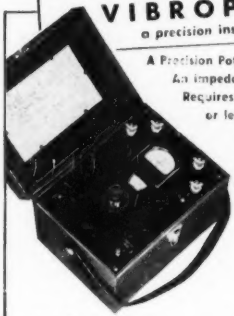

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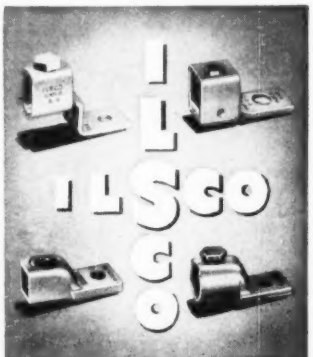

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Street Lighting Control

(*Continued from page 70*)

ever, the various multiple supply arrangements require the evaluation of street lighting losses on primary and secondary circuits most of which carry other loads. From studies made on portions of our system, we are reasonably satisfied that the losses incurred by the individually controlled luminaires are comparable with the losses of a series system that is supplying lamps at those same locations.

Benefits Secured

As for benefits from individual lamp control, one should consider the intangible factors to which dollar values are not easily assigned. The elimination of wires specifically for street lighting service will:

1. Reduce space requirements and perhaps permit shorter crossarms. At least the primary circuit can be spread out.
2. Reduce initial and maintenance tree trimming costs.
3. Eliminate complete street light circuit outages and long hours of labor restoring such service after dark.
4. Improve appearance of overhead lines through reduction in number of wires.
5. Increase safety through elimination of high voltage.
6. Improve lighting service from the customers' viewpoint by turning lights on when needed.
7. Increase availability of street lighting service in remote areas.

It is our belief, that this new individual control is a major improvement in street lighting service practice. We are saving much valuable time and expense in supplying approximately 1,500 new street lighting installations this year. It is possible that the cost of the control will drop to some extent as production increases, making the economics more favorable. Like all new developments, it has created some problems, but so far none that could not be solved. At present our use is pretty well confined to areas beyond existing series systems, but in future it may become desirable and economical to begin replacing series circuits as equipment wears out.

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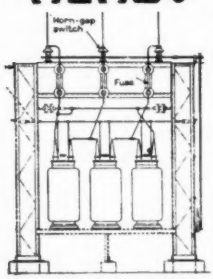

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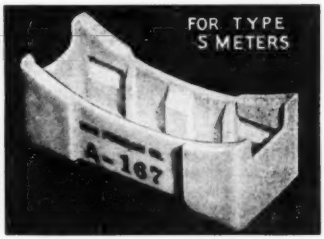

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LETTERS TO THE EDITOR

To the Editor of ELECTRICAL WORLD:

We wish to acknowledge your letter of August 11, 1949, and give you the following information in respect to the items of criticism mentioned in it:

1. ". . . co-ops were prevented from connecting hundreds of farms which have already been wired because the principal power supplier, Virginia Electric and Power Co, has limited capacity available from its facilities."

During the war years when strategic materials were drastically restricted, electric utilities were allowed only so much of equipment and materials as were specifically required to provide for increases in load caused by the war. At the end of the war, it was predicted in both governmental and private circles that the loads reached in 1945 would not be exceeded before 1948. Actually the quick snapback in business resulted in loads greater than the war loads before the end of 1946. Although a decrease in load immediately following the war was generally expected, Vepco went ahead with post-war expansion plans, anticipating a substantial increase in power demands over succeeding years.

During the period, somewhat long because of slow deliveries of materials and a tight labor supply, while new facilities were being secured and placed in operation, Vepco, though it tried to take care of all requirements of existing and prospective customers, including the co-operatives, was at times unable to supply the total amount of capacity requested of it. In fact, on a few occasions and for limited periods, it was obliged to reduce voltage in order to carry the loads which it had already taken on.

In 1948, it was necesary for Vepco to advise three co-operatives, B-A-R-C, Shenandoah Valley, and Northern Piedmont, that it could not then make commitments to supply additional power. Shenandoah Valley, at the time, was generating most of its power. In 1948 and early 1949 Southside Electric Co-operative claimed that it could not connect new customers because Vepco could not supply sufficient power to the co-operative. A temporary supply of power was made available to this co-operative.

In December 1948, our 60,000-kw Possum Point Power Station was completed and placed in operation and another 60,000-kw unit has recently been placed in operation at our Chesterfield Station. This additional capacity, together with additional capacity on

which construction work is already in progress, and interconnections with neighboring utilities now places Vepco in position to serve all foreseen loads and it has already notified the majority of the Co-operatives that it is in position to supply both their present and future requirements. The remaining co-operatives are now being advised of Vepco's ability to meet their demands both present and future.

2. "In new contracts . . . Vepco simultaneously effected a rate reduction and limited the amount of service available to even less than previous load requirements."

The new REA contracts, mentioned in the article in *Rural Electrification*, specified the amount of service available for each delivery point. These available amounts were greater than the actual maximum loads of the Co-operatives prior to that time in every case except one. This exception was a request for additional emergency service by Shenandoah Valley Co-operative for a part of its system which it was unable to supply satisfactorily from its own generating facilities.

3. "In addition, to get the power, some of the rural electrics will be required to make large investments to build their own transmission lines to connect with Vepco's system."

Nearly all the co-operatives served were initially supplied from relatively low voltage distribution lines. Delivery points for all except two of the co-operatives are widely separated and, in many cases, are remote from the company's transmission facilities. Furthermore, the expansion of the co-operatives' systems has caused a shifting of the Co-operatives' load centers resulting in frequent requests that the company furnish services at new locations. Obviously, as loads of the co-operatives grow, the need that they be served from the company's transmission facilities also grows and this brings up the question of building transmission lines to deliver power at transmission voltages to the co-operatives' load centers. The fixed charges on such lines extended to serve co-operatives, if they are built by the company, may be collected through an increased rate for electricity sold to the co-operatives over such lines. If the co-operatives choose to build their own lines or if such lines are not necessary, electricity could be made available at lower rates, and the question of which way this particular matter can best be handled is now under study. No definite conclusion has yet been reached with regard to it.

The letters referred to on p 26 in the August 1949 issue of *Rural Electrification* evidently were written in 1948 when Vepco's capacity situation was critical. Since then, Vepco's ex-

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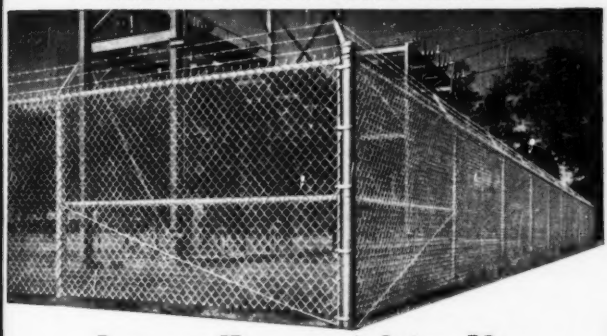

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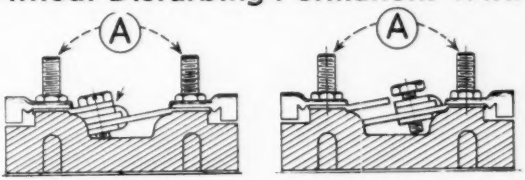

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Virginia Electric and Power Co
Richmond, Virginia

(Editors Note: This is an additional letter in the series published in the September 10 issue of ELECTRICAL WORLD answering charges made in the August 1949 issue of *Rural Electrification* magazine.)

Corps of Engineers Not TVA Operate Projects

To the Editor of ELECTRICAL WORLD:

The August 13 issue of ELECTRICAL World carries an article on p 77, entitled, TVA is Looking Ahead to a Rosy Future, Adding Units to Serve Rising Load. This article states that TVA is operating the Corps of Engineer's Dale Hollow project and will operate the Center Hill and Wolf Creek projects which the Corps of Engineers now have under construction.

The article is erroneous in stating that TVA operates or will operate these stations. The responsibility for the operation of these stations rests with the Corps of Engineers and the Corps of Engineers is carrying out that responsibility. Power produced by the Corps of Engineers at its Cumberland projects is delivered to the Tennessee Valley Authority for marketing under an agreement with the Department of the Interior.

W. E. Potter
Colonel
Corps of Engineers
Acting, Assistant Chief of Engineers for Civil Works
Washington, D. C.

(Editors Note: Col. Potter is correct.)

Standard Crossarm Brace Sizes

To the Editor of ELECTRICAL WORLD:

On Page 20, in your column headed "Technical Notes" you have a paragraph which reads as follows: "Crossarm Braces of the ¼ x 1¼ in. kind are still being ordered by many instead of the standard ¼ x 1⅞ in. Why?"

Just to prove that I read your column and to offer a correction, the standard EEI Crossarm Brace is ⅜ x 1⅞. As a matter of fact, I do not believe you could purchase a piece of steel ¼ x 1⅞. Perhaps this is just a typographical error, but, I thought you would like to have it brought to your attention.

R. M. Waggoner
Vice President
Hubbard & Company

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **OPPORTUNITIES** EQUIPMENT: USED OR RESALE

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An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

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NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

GRADUATE OF State Technical Trade College, Vienna, Austrian citizen, 27, three years engineering experience in power generation and transmission, good recommendations. PW-1326, Electrical World.

GENERAL FOREMAN of Electrical underground and power plant construction, 15 years experience. References. PW-1320, Electrical World.

ENGINEER, 51, BS, EE, 20 yrs. exp. Public utilities and industrial, can take charge small plant electrical division, send for resume. N. J. registered. PW-1289, Electrical World.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Sealed bids (Specifications No. 2816) will be received by Bureau of Reclamation, Denver, Colorado, December 6, 1949, and then publicly opened for furnishing three 16,667/20,834-kva, 6,900 delta- to 115,000 grounded wye-volt, 3-phase, 60-cycle, oil-immersed, self-cooled/forced-air-cooled, outdoor power transformers for Canyon Ferry Power Plant, Canyon Ferry Unit, Montana, Missouri River Basin Project. Delivery is desired within 840 to 1,020 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner. (101)

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Sealed bids (Specifications No. 2817) will be received by Bureau of Reclamation, Denver, Colorado, December 6, 1949, and then publicly opened for furnishing 5-kv., indoor, motor-control, metal-clad switch-gear assemblies for Wellton-Mohawk Pumping Plants Nos. 1, 2, and 3, Wellton-Mohawk Division, Gila Project, Arizona. Delivery is desired within 270 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner. (100)

WANTED

ANYTHING within reason that is wanted in the field served by Electrical World can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

ELECTRICAL DESIGNERS

ESTABLISHED BOSTON CONSULTANTS HAVE OPENINGS FOR ELECTRICAL ENGINEERS, DESIGNERS AND DRAFTSMEN WITH POWER PLANT AND INDUSTRIAL DESIGN EXPERIENCE.

P-1267, Electrical World
330 W. 42nd St., New York 18, N. Y.

TRANSFORMER MANUFACTURER

Looking for SALES Representation in Philadelphia Area for sale of Power and Distribution Transformers.

RW-9654, Electrical World
330 W. 42nd St., New York 18, N. Y.

WANTED

WANTED to BUY
WATTHOUR METERS
FOR SALE
SOCKET TYPE METERS
YOUR INQUIRY SOLICITED
ATLANTIC ELECTRIC METER CORP.
214 E. 41 St., New York 17

TRANSFORMERS WANTED

Purchase or Rent

Three each: 333 or 500 kva, single phase, 60 cycle oil cooled, new or used, primary voltage 4800—secondary voltage 240/480 with taps.

W-1303, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

RECTIFIERS WANTED

Up to 3000 amperes of Rectifiers or motor generator set. Input 220 or 440 volt, 3 phase, 60 cycles. Output 6 volts. Must be in good condition and low priced.

H. S. Boorman
WALL WIRE PRODUCTS CO.
Plymouth, Michigan

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short

Telephone: Eastgate 7-4778

PIERCE CABLE CO.
2670 Clybourne Ave. Chicago 14, Illinois

FROM AVAILABLE STOCK

TURBO GENERATORS

KW	Make	Desc.
4000	G.E.	Auto extraction—250 lbs. I.S.P. 35 lbs. ext.—2300 v. 3 ph. 60 cy.
750	G.E.	Condensing—250 lbs. I.S.P. 440 v. 3 ph. 60 cy.—Built 1944
450	Whse.	Condensing 250 lbs. I.S.P. 440 v. 3 ph. 60 cy
400	Whse.	Non-condensing 125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
5140	Whse.		2400/4150	600
4000	G.E.	TSC	2400/4150	900
3000	Whse		2400/4800	720

MOTOR GENERATOR SETS
3 ph. 60 cy.

KW	Make	Speed	DC Volts	AC Volts
1800	G.E.	600	125/250	2300/4150
1500	G.E.	360	275	2200/4400
1500	G.E.	600	600	2300/4150
1250	G.E.	600	275	4150
1000	Whse.	900	600	4150

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph	Voltages
2666	Whse.	OISC	1	66000x11000
2500	G.E.	DTQ	1	13200x3300
2500	Al. Ch.	OISC	3	13200x2300
2500	Pack.	AT	3	13800x2300
1250	G.E.	HVDDJ	1	6600x550
1250	Maloney	C	1	4160x240/480
1000	G.E.	HTI	3	13200x480
1000	Pitts.	OISC	1	13200x2300
750	Whse.	OISC	3	33000x2300
600	Al. Ch.	OISC	3	2300/4150x220/440
500	Whse.	OISC	3	13800x230/460
333	Pitts.	OISC	1	26400x2600
167	G.E.	HS	1	2400/240-480

BELYEA COMPANY, INC.
OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.
52 Church St., New York 7, N. Y.

ELECTRICAL CABLE
- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2670 N. Clybourn Ave., Chicago 14, Ill.

FOR SALE

4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

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50 CHURCH ST. DIgby 9-4350 NEW YORK 7, N. Y.

FOR SALE

One New Sauerman 3 Cu. Yd.

CRESCENT COAL SCRAPER BUCKET

Immediate Shipment

For Price Contact Mr. N. C. Stirewalt, V.P.

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY
Illinois Building Springfield, Ill.

FOR SALE *New—Never Used*
BOILER FEED PUMP, WORTH., 4-UX-2
600 GPM, 2310 ft. hd.
500 HP Allis-Chalmers Motor, ARW, 3-60-440, 3600 RPM. CH Starting Control
DELL STEPHENSON & CO.
2565 Guardian Bldg., Detroit 26, Mich.

TRANSFORMERS
FOR SALE

3—500 KVA A-Ch 33000-2300
3—500 KVA G-E 2400-240/480
3—500 KVA G-E 11500-2300/4000Y
3—333 KVA G-E 33000-2300/4000Y
3—333 KVA G-E 13800-120/240
3—333 KVA G-E 2400/4160Y-240/480
1—250 KVA G-E 6900/11950Y-230/460
3—200 KVA G-E 6900/11950Y-230/460
3—200 KVA G-E 6600/11430Y-2300
3—200 KVA W-H 2300-460/230/115
3—150 KVA G-E 11000-2300/4000Y

3-phase

2—1500 KVA G-E 33000Y-2300Y/575
1—1800 KVA Wag 6600-575

Many other items in stock

TRANSFORMERS
WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

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(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

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Productive advertising is an INVESTMENT rather than an EXPENDITURE.

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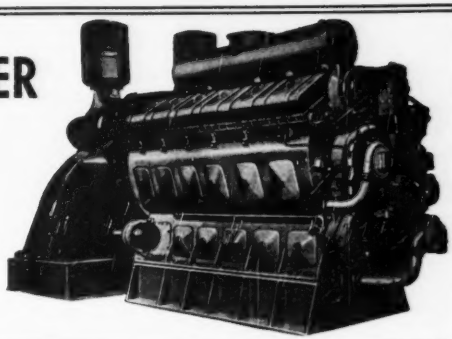
330 W. 42nd St., N. Y. 18, N. Y.

DIESEL ELECTRIC POWER

FOR

IMMEDIATE DELIVERY

UNIT CAPACITIES—10 TO 1875 KVA
A. C.—50 AND 60 CYCLES
ANY VOLTAGE



A PARTIAL LIST OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	33F16	2000	300	375	Enterprise	DSG-6	450	450
1420	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KNA	396	514
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
937.5	General Motors	12-567	1080	720	187	Ingersoll Rand	S	225	514
625	Alco	6-12½x13T	750	600	125	General Motors	3-268A	150	1200
425	Baldwin	VO-6	510	450	75	General Motors	6043C	90	1200

WRITE FOR COMPLETE INFORMATION

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER Company, Inc.

ESTABLISHED 1898

Diesel Engines • Power Machinery

ENGINE DIVISION 50 CHURCH STREET, NEW YORK 7, N. Y.

Sealed bids
will be received on or before
November 28, 1949.

4—Connelly Water tube boilers, 4 drum 365 H.P. equipped with type A Cox grate stokers.

1—General Electric Turbo-Generator straight condensing 1000 K.W. 1250 KVA 3600 R.P.M. 2300 volts operating pressure 200 PSI 3 stage equipped with the following:

1—Steam driven D.C. generator No. 663325 type cc 351 cvv 3600 R.P.M. volts 125 Amp 280 G.E. Curtis Turbines No. 22638 KW 35 3600 R.P.M. form 3 1 stage 135 PSI G.E.

1—Alberger Pump and condenser size 30 D No. 11092 motor on pump G.E. No. 8931 type LTC 343-8-75-1200 3 phase 60 cycle 220 volts 1150 R. P.M. 75 H.P. #415502.

Municipal Light & Power Plant
South Vine Street,
PORTLAND, INDIANA

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS
1000 KW TO 100 KW
STATIONARY AND PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Telephone NEvada 6-2808
Cable Address HEMCOY

1412 So. Alameda Street
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REBUILT ELECTRIC WATTHOUR METERS
Large quantity, ac. 60 cy, single phase, 120v., mostly 5 amps. new type, GE. Wstghse, Sangamo. $3.50 each

OIL FILLED TRANSFORMERS
600 each, 2400-120/240 (old style) 1½, 3 & 5 KVA. with and without taps 4.00 Per KVA.

MICORTA (canvas base) **bakelite TUBING,**
Nat. Fibre Co. product, about 4,000 pieces, 29/32" ID, 2-9/32" OD. 90% 8" long, 10% 6" long, Approx. 35,000 total inches, .02¢ per inch.

L. NABUT
WEATHERLY BLDG. PORTLAND, ORE.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

160G 53rd St., NORTH BERGEN, N. J. N.Y.C. Tel. LOngacre 5-3221 N. J. Tel. UNion 3-2600

SLIP RING MOTOR
1—2500 HP G.E. MT. 257 RPM 6600 V
1—500 HP G.E. MT. 720 RPM 2200 V 4150.

SYNCHRONOUS CONDENSER
1—2500 KVA Whse 720 RPM 2200 V with D.C. exciter.

MOTOR GENERATORS
1—1000 KW Whse. 275 V. 720 RPM 4150 volt
1—1000 KW G.E. 600 V. 514 RPM. 2200/4000 V
1—500 KW G.E. 275 V. 900 RPM. 4150 volt

TRANSFORMERS
1—1000 KVA G.E. 3 ph. 4150 V-2400 V
1—1000 G.E. 3 ph. 4150, 2 ph. 2400 V.
3— 400 KVA G.E. 6900 V. Pri. 2300 V Sec.
3— 300 KVA Pitts. 2400 V Pri. 120/240 Sec.
3— 300 KVA G.E. 2400 V Pri. 120/240 Sec.
3— 150 KVA Whse. 2300 V Pri. 240/480 V Sec.
3— 100 KVA G.E. 4150 V Pri. 240/480 V Sec.
Pyranol Inerteen
6— 50 KVA Whse. 4150 V Pri. 120/240 V Sec.

Complete Line of A.C. and D.C. Motors and Generators

Lower your overhead maintenance costs!

Aero's New Aluminum Aerial Platform Ladder.

Cut your man hour costs for overhead maintenance and repair to the bone. Reach inaccessible places quickly and easily from a safe, aerial platform. Overhead wiring — line inspection — lighting fixture bulb replacement — painting and numerous other time consuming maintenance operations are accelerated and made simple with the new Aero Metalcraft Extruded Aluminum Platform Ladder. You can mount it on any suitable (¾ ton and up) truck platform or braced body roof. For inside maintenance operations mount it on most platform-type materials handling trucks. Requires only one man to erect ladder.

- Extends to 28 Ft.
- Rotates 360°
- Inclines 45°
- Manual or Hydraulic Actuation
- Strong, lightweight construction of Extruded Aircraft Aluminum Alloy
- Minimum Maintenance Costs
- Interior or Exterior Uses

Learn all about this new Aero Metalcraft development and what it means to you.

Send for free descriptive folder — today!

METALCRAFT AERO CORPORATION

Licensed Manufacturer

AERO
METALCRAFT
CORPORATION
Rockleigh, New Jersey
P.O. Box 431, Englewood

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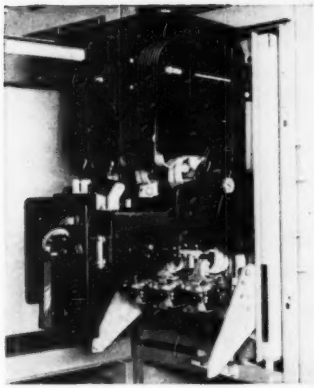
Greater Circuit Breaker ACCESSIBILITY



ANOTHER REASON TO BUY:

MULTUMITE 600

I-T-E's IMPROVED LOW VOLTAGE SWITCHGEAR—WITH METAL-PANEL CIRCUIT BREAKERS

→ It's easy for your operators and maintenance men to get at this circuit breaker. When racked to the fully disconnected position it is in the clear . . . easily accessible from front, sides and bottom . . . does not have to be removed from compartment for inspection . . . when removed, self-standing on metal "feet".

Greater circuit breaker accessibility is only one of the many advantages that make Multumite "600" your best switchgear buy. I-T-E engineers have incorporated all time-tested and proved I-T-E features with latest switchgear developments. Result: an improved switchgear assembly with construction emphasis on greater all-around accessibility, safety and compactness.

PLUS GREATER SAFETY:
Completely metal-enclosed . . . circuit breakers and bus compartments effectively separated by metal panels of breakers . . . even control wiring is enclosed in metal wiring troughs.

AND ADDED SPACE-SAVINGS:
New narrow-width design cuts down on over-all board length . . . permits four-high stacking of 15,000 amp.-rated circuit breakers, three-high stacking of 25,000 and 50,000 amp.-rated electrically or manually operated breakers.

GET THE COMPLETE STORY

A new, fully illustrated bulletin telling the complete story of Multumite "600" is available now. We will be glad to send you a copy. Write for Bulletin 6003-D. Your local I-T-E representative will be glad to give you all the pertinent information on Multumite "600". Consult him without obligation.

SPECIFY I-T-E FOR DEPENDABLE SWITCHGEAR

I-T-E Circuit Breaker Co., 19th & Hamilton Streets, Philadelphia 30, Pa.

Power Switching Equipment Division: Railway & Industrial Engineering Co., Greensburg, Pa.
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Phillips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

NO. 5 OF A SERIES

DO YOU BUY TRANSFORMERS BY HABIT OR BY MERIT?

Here's An Important KUHLMAN Saf-T-Kuhl Merit: BETTER VOLTAGE REGULATION!

Kuhlman Saf-T-Kuhl transformers are filled with a non-inflammable, non-explosive, inert cooling fluid. This makes them 100% safe — permits them to be installed right at load centers. Result: *greatly improved voltage regulation and reduced power losses!*

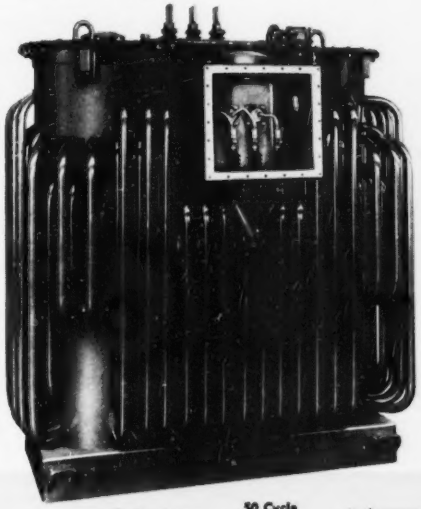
The expense of running long lines of secondary copper is avoided, too, since Kuhlman Saf-T-Kuhls make it possible to divide electrical circuits into several sections. And because Saf-T-Kuhl transformers may be installed with perfect safety anywhere in a plant — below floor level, at floor level, or up above manufacturing equipment near the ceiling — all available floor space is saved for productive units.

No matter where Saf-T-Kuhls are installed, they assure you of *complete protection against fire or explosion.* This eliminates the need for expensive fireproof vaults and, in many states, results in lower insurance rates.

●

Kuhlman Saf-T-Kuhl transformers are built with the same care and precision that is a feature of all Kuhlman transformers. In ratings 25 KVA and below, transformers feature Kuhlman's pioneering Bent Iron Core, with its superior operating and weight-saving characteristics. Core and coil assemblies are especially insulated and finished for Saf-T-Kuhl immersion. Operating handle of tap changer extends well above fluid level. Large ducts in windings assure free coolant circulation, eliminate danger of "hot spots". Cover and bushing gaskets are of a special long-life rubber compound. Relief diaphragm is standard equipment on all single phase ratings 37½ KVA and higher, and on three phase ratings 30 KVA and up. Gas absorbers are optional equipment on all ratings.

Keep Kuhlman in mind for the most efficient answer to *all* your transformer problems.



Primary side complete assembly 1000 KVA, Saf-T-Kuhl Transformer rated 60 cycle, 3 phase, 13,800—240 volts with taps. Transformer pictured with junction box cover removed.

KUHLMAN FACT FILE
SAF-T-KUHL TRANSFORMERS

TRANSFORMER TOPICS

QUESTION:

A dry type Class B insulated transformer rated 500 KVA, 2400 to 480 volts, 3 phase, 50 cycles, is being considered for use at 60 cycles at the same KVA and voltage rating. Performance data at 50 cycles are given below. What is the estimated performance at 60 cycles? Compare with the performance of a transformer designed for 60 cycle service.

ANSWER:	*Performance at 50 Cycles*	*50 Cycle Transformer Operated at 60 Cycles*	*Performance 60 Cycle Transformer*
Core Loss Watts	2250	1940	2215
Copper Loss Watts	3010	5250	4555
Eddy Loss Component Watts of Copper Loss	530	770	
% I R	1.00	1.05	.91
% I X	4.90	5.88	4.91
% Impedance	5.00	6.05	5.0
Regulation			
100% P F	1.12	1.22	1.03
.80% P F	3.83	4.50	3.80
% Efficiency			
Full Load	98.55	98.57	98.66
¾ Load	98.65	98.70	98.75
½ Load	98.60	98.70	98.68
¼ Load	97.95	98.20	98.02

Kuhlman ELECTRIC COMPANY . BAY CITY, MICHIGAN

EXPORT REPRESENTATIVES: *International Standard Electric Corporation*, 67 Broad St., N. Y. City, N. Y. Cable Address: Microphone, N. Y.